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H. Preston Hoskins, Secretary-Editor, 716 Book Building, Detroit: Mich.

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SANITARIANS ALL

For the third time we are publishing, in a single issue of the Journal, the entire proceedings of a meeting of the United States Live Stock Sanitary Association. It is quite a job, but well worth the effort. The field of the U. S. L. S. S. A. so well supplements the field of the A. V. M. A. that the combined proceedings of the two organizations, as published in the Journal, give practically a complete résumé of veterinary progress in America from year to year.

When the cooperative arrangement was inaugurated, two years ago, Secretary Dyson expressed a fear that there would be a resultant falling off in the membership of the U. S. L. S. S. A., simply because some members would not want two copies of the report of the proceedings. Under the present arrangement, members of the A. V. M. A. get the proceedings in the form of an issue of the Journal. If these members also belong to the U. S. L. S. S. A., they get a copy of the proceedings in the form of a reprint of the report as published in the Journal. It is only in those cases where veterinarians hold membership in both organizations that two copies of the proceedings are received. Our suggestion would be, to those members who have no particular use for the extra copy, to pass it on to some veterinarian who is not a member of either Association. It might influence him to join one or the other.

The report of Secretary Dyson for 1926 showed 304 members of the U. S. L. S. S. A. The report for 1928 shows 388 members. This is pretty good evidence that veterinarians holding membership in the A. V. M. A. have not withdrawn their support from the U. S. L. S. S. A. to any appreciable extent. We hope that none will do so. The organization fills a distinct need and merits the support of every veterinarian in the country who is in any way interested in live stock sanitation. That ought to include practically everybody.

IOWA MEANS BUSINESS

The General Assembly of Iowa passed a law on February 19, 1929, making the eradication of tuberculosis a state-wide project. Prior to the passage of this law, the eradication of tuberculosis was conducted on a plan of local option. Of the 99 counties in the State, 69 had already adopted the county plan. Some of the 30 remaining counties had voted against the plan. However, the fact that more than two-thirds of the counties had placed their stamp of approval on the plan seemed to be sufficient recommendation for the General Assembly to go ahead and make the eradication of tuberculosis a state-wide project, rather than leave it to the individual counties. This is sound business. It is really unfair to those counties that have cleaned up, to be compelled to remain exposed to infection coming from those counties which have declined to eradicate the disease. The policing of boundary lines between clean counties and those containing variable amounts of infection is extremely difficult and in a state like Iowa, where sentiment was so preponderantly in favor of eradicating tuberculosis, the action of the General Assembly was the only logical move. Even though this action may be somewhat distasteful to those backward counties which have opposed tuberculosis eradication on a systematic basis, it is only a question of time when these same counties will see the light and be thankful for what the General Assembly has done in their behalf.

EXECUTIVE BOARD ELECTIONS

Elections are now in progress in two Executive Board districts of the A. V. M. A. The election in Executive Board District No. 2 has been in progress since November 12, 1928. The nominations were closed on January 12, 1929, and the polls for the

election proper were opened at that time. The polls for this election will be closed March 12. This election is being held for the purpose of electing a member of the Executive Board to represent District No. 2 for the unexpired term of Dr. T. E. Munce, who resigned following his election to the presidency. Dr. E. P. Althouse, of Sunbury, Pa., is filling a temporary appointment to this office.

This is the year for the regular election of a member to represent District No. 4, the South. Ballots asking for nominations were mailed to all paid-up members in the District on February 13. The District is comprised as follows: Kentucky, West Virginia, Virginia, Maryland, District of Columbia, Tennessee, North Carolina, South Carolina, Georgia, Alabama, Mississippi, Florida, Cuba and South America.

No ballots in either election have been mailed to members whose dues for 1929 have not been paid. The Constitution and By-laws specifically provide that no member may participate in any election unless his dues are fully paid up to date. The use of the new edition of the A. V. M. A. Membership Directory is strongly suggested in connection with making nominations. Several ballots have already been received containing the names of members who are not located in the district in which the election is being held. Nominations will be received up until April 13, on which date the polls will be closed and a ticket made up, containing the names of the five nominees receiving the first, second, third, fourth and fifth highest numbers of nominating votes.

OHIO STATE VETERINARY CONFERENCE

The fourth annual veterinary conference of the College of Veterinary Medicine, Ohio State University, will be held March 20-21-22, 1929. This year it is proposed to extend the program to include not only sessions in veterinary art but actual laboratory courses in serology and parasitology. The sessions in veterinary art will be held each evening of the conference and the discussions will cover, in the main, the subjects presented during that day. At these sessions the practitioner will have ample opportunity to have his questions discussed by leaders in the profession. Leaders have been chosen for these sessions, to bring out, as far as possible, the latest and best in veterinary practice and to do so from the angle of the busy practitioner. These discussions will give the man in the field something he can take home with him and use in

his practice for the benefit of the live stock owners of the community.

The laboratory courses will be given concurrently, so that the practitioner must select the one in which he is most interested. It is arranged so that those selecting a laboratory course can attend the general sessions of the conference during the afternoon and evening.

The course in serology will consist of a brief discussion of the theoretical and practical application of the agglutination test, with especial reference to the diagnosis of bacillary white diarrhea and infectious abortion. The course in parasitology will consider the more important parasites affecting the domestic animals and various diagnostic methods. There will be sufficient practical laboratory work in each of these courses to familiarize one with their application in a routine practice.

Through the conference the University hopes to reach the animal husbandry of the State, employing the veterinarian as its medium of communication. By this means the College of Veterinary Medicine extends its service to the live stock industry through the veterinary profession. Veterinarians of Ohio and neighboring states are invited to be present during the entire program.

APPLICATIONS FOR MEMBERSHIP

(See December, 1928, JOURNAL)

FIRST LISTING

BECK, WALTER H. 722 State Office Bldg., Lansing, Mich.
V. S., Ohio State University, 1908
Vouchers: T. S. Rich and M. P. Hunt.

BINGHAM, FRANCIS S. 824 Topeka Ave., Topeka, Kans.
D. V. S., Kansas City Veterinary College, 1907
Vouchers: N. L. Townsend and C. B. Clement.

BOOTH, RUSSELL BERKINS 148-15 Hillside Ave., Jamaica, N. Y.
D. V. M., Cornell University, 1927
Vouchers: James Elliott Crawford and C. G. Rohrer.

CHILDS, JOHN W. 13476 Washington Blvd., Venice, Calif.
D. V. M., Colorado Agricultural College, 1928
Vouchers: W. L. Curtis and J. P. Bushong.

COOK, LEWIS J. 816 S. San Pedro St., Los Angeles, Calif.
D. V. M., McKillip Veterinary College, 1918
Vouchers: W. L. Curtis and J. P. Bushong.

DUCKWORTH, CHARLES UNDERWOOD Capitol Bldg., Sacramento, Calif.
D. V. M., Indiana Veterinary College, 1921
Vouchers: W. L. Curtis and J. P. Bushong.

HIGH, FLOYD W. 901 College Ave., Mt. Pleasant, Mich.
V. S., Ontario Veterinary College, 1914
Vouchers: M. P. Hunt and T. S. Rich.

HUGGINS, MATTHEW JAMES Edwardsville, Ill.
D. V. M., Chicago Veterinary College, 1913
Vouchers: H. S. Wooters and A. A. Moore.

JACKS, JAMES P. 615 San Fernando Bldg., Los Angeles, Calif.
D. V. S., San Francisco Veterinary College, 1911
Vouchers: W. L. Curtis and J. P. Bushong.

KIMNACH, GUSTAV HENRY Hightstown, N. J.
D. V. M., Chicago Veterinary College, 1914
Vouchers: J. G. Hardenbergh and Henry H. Haigh.

LOGAN, A. FLOYD Box 49, Mt. Clemens, Mich.
V. S., Ontario Veterinary College, 1914
Vouchers: M. P. Hunt and B. J. Killham.

MADELL, WALTER J. 422 Hill St., Jackson, Mich.
D. V. M., Grand Rapids Veterinary College, 1915
Vouchers: M. P. Hunt and T. S. Rich.

MILLS, HORACE ARTHUR Johnson Hotel, Salem, N. J.
D. V. M., Kansas State Agricultural College, 1927
Vouchers: J. G. Hardenbergh and Henry H. Haigh.

MORRIS, MARK LOREN Lincoln Highway, Stelton, N. J.
D. V. M., Cornell University, 1926
Vouchers: H. C. Millar and Harmon K. Wright.

MURRAY, BENJAMIN FRANK 5331 College Ave., Oakland, Calif.
D. V. M., Cornell University, 1914
Vouchers: Joseph M. Arburua and John M. McInnes.

PINKHAM, CHAS. F. Throop Hotel, Topeka, Kans.
D. V. S., Kansas City Veterinary College, 1909
Vouchers: N. L. Townsend and C. B. Clement.

ROSS, KENNETH 3800 Grand River Ave., Detroit, Mich.
B. V. Sc., Ontario Veterinary College, 1927
Vouchers: E. E. Patterson and A. S. Schlingman.

ROSS, W. J. 2649 Walnut, Huntington Park, Calif.
D. V. S., San Francisco Veterinary College, 1909
Vouchers: W. L. Curtis and J. P. Bushong.

SEEVERS, HARRY 5614 East Michigan St., Indianapolis, Ind.
D. V. M., Cincinnati Veterinary College, 1916
Vouchers: F. W. Dennie and Benj. H. Yenner.

STAGNER, ALBERY HENRY Hudson, Ill.
D. V. M., Chicago Veterinary College, 1915
Vouchers: John D. Reardon and W. H. Welch.

STONE, RAYMOND V. 829 S. 6th St., Alhambra, Calif.
D. V. M., San Francisco Veterinary College, 1917
Vouchers: W. L. Curtis and J. P. Bushong.

THOMAS, CHAS. A. 1212 Reed St., Kalamazoo, Mich.
D. V. M., Chicago Veterinary College, 1912
Vouchers: M. P. Hunt and B. J. Killham.

WHITE, CHARLES B. Stanford, Ill.
D. V. M., McKillip Veterinary College, 1914
Vouchers: John D. Reardon and W. H. Welch.

WILLIS, ROY EMIL c/o Y. M. C. A. Rm. 408, Jersey City, N. J.
D. V. M., St. Joseph Veterinary College, 1922
Vouchers: J. G. Hardenbergh and Henry H. Haigh.

Applications Pending

SECOND LISTING

Bergan, Joseph Arthur, 2851 E. 5th St., Long Beach, Calif.
Bollmeier, William Theodore, 641 N. 9th St., East St. Louis, Ill.
Brown, Sylvester, 810 Hoadley St., Whittier, Calif.
Brunson, Robert Leroy, 918 Sheridan St., Corona, Calif.

Bushong, Rex Dean, 810 Houston St., Manhattan, Kans.
Campbell, Harvey W., 42A So. Catalina St., Ventura, Calif.
Clemmer, Homer R., Staunton, Va.
Davidson, Walter W., 249 E. Jackson St., Stockton, Calif.
Delez, Arthur Louis, University Farm, St. Paul, Minn.
Dunlap, Glen LeRoy, Massachusetts Agricultural College, Amherst, Mass.
Edwards, Frank, 323 Chester Ave., Bakersfield, Calif.
Elberson, Noel C., 15 E. 6th St., Anderson, Ind.
Foley, Timothy J., Frankfort, Kans.
Fosbinder, Harry Risdon, 1844 No. Berendo St., Hollywood, Calif.
Fuchs, George Andrew, 125 Hackberry Ave., Modesto, Calif.
Gould, Homer A., 80 N. Daisy St., Pasadena, Calif.
Griffiths, C. B., 4226 E. Sacramento, Chico, Calif.
Griner, Adlai Bee, Box 203, Fitzgerald, Ga.
Heitt, Jay Lewis, 1235 Johnson St., Red Bluff, Calif.
Kennedy, George Ralph, Box 183, Chase, Kans.
Keppel, John, 116 Center St., East Lansing, Mich.
Ketcham, Harold Fuller, Box 1337, Pawhuska, Okla.
LaBar, Chauncey F., 606 Congress St., Ypsilanti, Mich.
Little, Harold F., St. George Hotel, Santa Cruz, Calif.
McCrillis, John J., 28 Valley St., Pasadena, Calif.
McGarry, John A., 158 Front St., Santz Cruz, Calif.
Parrish, R. D., Porterville, Calif.
Proper, C. F., Box 1394, c/o P. M. Dairy, San Diego, Calif.
Ramsey, Roy L., 114 Monroe St., Lapeer, Mich.
Reid, Francis Joseph, St. Marys, Kans.
Robb, Joseph Ralph, 888 Home Ave., Oak Park, Ill.
Root, Robert R., Tres Pinos, Calif.
Schattenburg, August E., Riley, Kans.
Schmidt, Albert Irving, Box 367, Cos Cob, Conn.
Seabury, William Augustus, 818 N. D St., Madera, Calif.
Settle, David Earl, 405 E. Butte St., Willows, Calif.
Spurlock, Jake Harvey, State Office Bldg., Trenton, N. J.
Stevens, Chauncey C., 1218 Minnie St., Port Huron, Mich.
Timmis, R. W., 1537 East 12th St., Oakland, Calif.
Tuttle, Lewis Edmund, Willows, Calif.
Walter, Charles, P. O. Box 846, Zionsville, Ind.
Watkins, S. E., Hanford, Calif.
Wimsette, Ira G., Wellington, Kans.
Winter, Asa, Devils Lake, Mich.
Winter, John H., 130 Toledo St., Adrian, Mich.

The amount which shall accompany an application this month is $9.16, which covers membership fee and dues to January 1, 1930, including subscription to the Journal.

COMING VETERINARY MEETINGS

New York City, Veterinary Medical Association of. Academy of Medicine, 5th Ave. and 103rd St., New York, N. Y. March 6, 1929. Dr. Raymond J. Garbutt, Secretary, 305 W. 91st St., New York, N. Y.

Southern California Veterinary Medical Association. Chamber of Commerce Bldg., Los Angeles, Calif. March 20, 1929. Dr. W. L. Curtis, Secretary, 1264 W. 2nd St., Los Angeles, Calif.

Maine Veterinary Medical Association. Congress Square Hotel, Portland, Me. April 10, 1929. Dr. D. F. French, Secretary, 87 Summer St., Rockland, Me.

Report of the Proceedings

of the

Thirty-second Annual Meeting

of the

United States Live Stock Sanitary Association

Chicago, Illinois, December 5-7, 1928

WEDNESDAY MORNING, DECEMBER 5, 1928

The opening session of the thirty-second annual meeting of the United States Live Stock Sanitary Association, held at the La Salle Hotel, Chicago, Illinois, was called to order at 10:15 a. m., by President C. A. Cary.

PRESIDENT CARY: Gentlemen, it is with pleasure that I call to order the thirty-second annual meeting of the United States Live Stock Sanitary Association.

The first thing we have on the program this morning is an address by Dr. Arnold Kegel, Commissioner of Health, Chicago. Dr. Kegel! (Applause)

OPENING ADDRESS

By DR. ARNOLD KEGEL, *Chicago, Ill.*

Commissioner of Health

MR. PRESIDENT AND GENTLEMEN:

It is my pleasure to extend to you a welcome to Chicago and to the Chicago Health Department, and to offer to you any facilities which we may have and which may be of interest or value to you.

I am not going to make a long talk. I just wish to touch a few of the high spots of our activities in the Health Department in which your interests and our interests probably meet on a common ground.

Tuberculosis, in spite of many years of interest and concentrated efforts, remains perhaps the largest problem that we have before us. Although the tuberculosis rate has been dropping in most all the ages of human beings, this year we find that there is an increase of tuberculosis, especially in young people. We view with considerable alarm that young folks, fourteen, fifteen and sixteen years of age, should have an increased rate in tubercu-

losis. We are analyzing the situation, analyzing our figures, and we have not yet come to conclusions as to what might be the cause. We are using every means to keep down the incidence of tuberculosis. We are making thorough examinations of as many school children as possible. Every case of tuberculosis is traced down to its source, every contact is watched closely, and every case of tuberculosis is isolated. In many cases, this much be done forcibly and it falls upon the Health Department to do this very disagreeable task.

For so many years tuberculosis was not considered contagious in the same light that smallpox, scarlet fever and typhoid were, and it is hard to educate even the doctors to the necessity of isolation. However, we are going ahead with our police work in this respect.

We are hoping to attack the problem from a new angle at this time. We are instituting in the schools of Chicago a thorough and very comprehensive system of examination of every school child as well as pre-school children.

We have recently completed a survey of the children in the schools. We examined 156,000 school children and found that 85 per cent of them had defects of some kind or another, and 71 per cent of them had defects which were severe enough to require some sort of corrective measure. These conditions consisted mainly of those of malnutrition and anemia, rickets, diseased tonsils, diseased teeth, orthopedic defects, defects in eyesight, and other conditions which are a handicap to the child, and especially a handicap in the way of progress, and which keep down its health in later years. We hope by eliminating all these defects that we will raise the resistance of those children, especially against tuberculosis.

We were considerably interested in the work of Calmette, and this summer I designated two men to go over to Europe to study the Calmette method and its results. Dr. Hoffman, a very able man, capable of making a fair survey, visited the north of Europe, Norway, Sweden, Denmark, Germany, Austria and England. He found that at no place in Europe is the Calmette method of vaccination against tuberculosis accepted by any official agency. There is a great deal of discussion concerning vaccination; there is a great deal of argument pro and con, but nowhere has anyone in authority felt justified in taking up the matter.

The Germans and the Austrians were particularly averse to the Calmette system. Dr. Juhnke visited the southern countries

in Europe, Belgium, Italy, France, Spain and Portugal. Outside of Calmette's laboratory, he found little to support his work, so that it seems that Chicago, at least, will not take up vaccination against tuberculosis according to Calmette, for some time to come. We will have to have a good many more figures. (Applause)

Chicago's milk supply is protected as much as it is humanly possible to protect it, we believe. We regret very much the necessity of shutting off on an average of 100 farms a day on account of faulty sanitary conditions and on account of late tuberculosis certificates and other conditions. However, we have felt it a necessity to do that, especially this summer and this fall, when the bacterial count in milk was rather high. We understand that this condition prevailed in other parts of the country as well as here. However, we covered 100 per cent of the milk that came into Chicago.

I have just been asked, a few moments ago, by some members of your society to permit them to go over our system of inspection, and I want to extend the invitation to the rest of you. If any of you wish to investigate or go over our system and give us any suggestions for improvement, or if we can give you anything toward it, I believe it would be of mutual benefit.

I am not going to say anything concerning a very interesting piece of work with regard to tuberculosis in cattle that I attended in Springfield about a month ago, when Dr. Larson, Dr. Laird and the others terminated their experiments on vaccination against tuberculosis in cattle. I believe Dr. Larson and Dr. Evans are going to present this tomorrow. It was a very interesting piece of work. Although it was disappointing, I believe it is a step forward in our understanding of the condition.

Chicago has been particularly free from undulant fever among humans as far as we know. I recently wrote a bulletin on the subject, drawing the medical profession's attention to the disease, and shortly thereafter one doctor found two cases in his practice. The fact that one doctor found two cases in his practice does not mean that we are entirely free of undulant fever among all the patients in Chicago. It means that one doctor happened to be quite alert and found the condition. We may have many, many more cases. It is singular that both these cases came from outside the city. They had been away on their vacations and had been drinking milk which was not pasteurized.

Ninety-eight per cent of Chicago's milk is pasteurized at 145 degrees. We have had many requests made to bring it down to 144 or 143, but each time, as we are just on the verge of cutting it down a degree, something comes up. The last time, just as we were on the verge of permitting it, there was an outbreak of typhoid about 100 miles from Chicago, in which there were 94 cases before we were notified of the condition. We felt, then, that it was a pretty safe thing to keep our pasteurization up at 145 degrees for a while yet at least.

The Health Department has been taking a special interest of late in tuberculosis in poultry. Our Dr. King, with his staff of veterinarians, is making examinations of thousands of poultry each day, and it has been a revelation to me to find the large number of poultry that are affected with tuberculosis. Dr. King will make a report of that a little later on, when his figures are completed.

We find that it is impossible to use ordinary inspectors, especially of the political type, for investigating tuberculosis in poultry, and we are eliminating those men at this time and replacing them with veterinarians entirely. (Applause)

May I extend to you again an invitation to come over to the Health Department or to let me know if there is any thing in particular that you are interested in. Obviously, I can not cover all the subject here now, but if there is anything of special interest at any time while you are in Chicago, please let me know. Thank you. (Applause)

President Cary: President Coolidge, in his last message to Congress, said, "The present condition is satisfactory and the future is optimistic." I think from Dr. Kegel's speech that the present condition of Chicago is somewhat satisfactory and the future is optimistic, for the good work that will be done here along lines of sanitation.

I should much prefer not to give you some of the advice I may hand out to you this morning, and I should much rather have an alibi something like the young nigger woman had in our city of Mobile. Saturday night she went to her mistress and said, "Miss Mary, I am going to get married tomorrow and I may not be back Monday morning."

Monday morning came around and the cook came in on time as usual, Mary said to the cook, "What is the matter? Didn't you get married yesterday?"

"Yes," she said, "I got married and we were going to take a honeymoon, but John said he wanted to go to Memphis and I had been to Memphis so he took an alibi."

"Why," she said, "what do you mean by that?"

She said, "I sent my sister." (Laughter)

I should rather have somebody else deliver this address which I am going to give to you. I should take an alibi, but I can't do it very well.

I want you to remember that I regard the situation as a whole in all the states, and the federal work as far as I know, very satisfactory. I believe the work in general through the entire United States, and, as far as I know, Canada and other parts of North America, has moved along progressively to great advantage to all the country concerned. I am not prepared to give you details, but I want to go over a few things that have come to me through the years I have had in this line of work. I don't know whether I am right altogether, because I don't know a lot of things. The older I get in this work the more I find there are a lot of things we don't know and that we have been working along theoretical lines in some ways and haven't gotten where we ought to be in some things.

THE ADDRESS OF THE PRESIDENT

By C. A. Cary, *Auburn, Ala.*

Members of the Association and Guests:

Let me review some of the diseases a little. I am not going to try to review them all in the brief time I have, but I want to review some of the diseases which we are trying to handle under our dominion, the live stock sanitary work of these United States.

One of the first things we have to know and must know, if we are going to control, prevent or eradicate a disease, is the cause of that disease. That seems very simple in a good many of them, but when you come to analyze each one of these diseases and to look at them squarely and fairly and be honest about your opinion and the other fellow's opinion as to what we know, you find we don't know a lot about some of them, and yet we are trying to handle them. I will take up some of these individually to show you what I mean.

Tick Eradication

I shall take up the one with which I am most familiar and with which we have done most of our work in the South, that is tick eradication. What do we know about it? We know its cause; we know the hosts of this cause and the carriers of it, and as far as we know all there is to know about it is the animals it is in and wherever else it is found. That knowledge gave us this position: We found out where to fight it at its vulnerable point. Knowing that this parasite had different hosts, we decided to attack it in the host that we could destroy. In other words, we wanted to stamp it out by the stamping-out method. And we are doing it over great areas and it is not returning unless we return some of these factors that carry the infection. I don't know of any disease that I have ever worked with in which we have accomplished so accurately and completely the process of eradication. Of course this means the control and prevention of the

disease, but in the end it is eradication. I want you to get that point.

I want to project this problem to you. We are never going to get rid of any disease without eradication. I could give you the details of this and you would have it and get it in print, but I am not going to stop to worry you with the details. I want to take up the next disease that is most considered or has most attention and is referred to by Dr. Kegel as the great disease of man and animals, and that is tuberculosis.

Just a moment about that: We handle it, yes; we control it, yes; we prevent a lot of it, yes; and we eradicate it up to a certain point. We have gotten along that far. As we go along with it we annihilate the source of the trouble. What is the end? Eradication. That is successful. The only trouble is that when we think we have got everything we go back and find something that we have left behind once in a while. We find that in tick eradication. We have left behind some infestation of ticks and we have to go back and get it. Right now I gather from the talk given yesterday at the research meeting over at the Sherman House that some places they are leaving infected soil. We don't know all about that yet. There are some points there that we haven't got. We have to go back and get them. It isn't a question of how much we talk about methods and everything else, it is getting all infection before we get rid of it, before we eradicate it. The end is eradication there just as in tick fever, and that is the only salvation if we are going to get anywhere with it and annihilate it. Every once in a while somebody says that can't be done. I know when we started out we didn't know what we could do with tick eradication. The fact of the matter is I met with the first men that started in tick eradication; about four out of six of the men that met in Atlanta to start the movement, statewide and country-wide, were opposed to it and said it could not be done. A lot of men now say tuberculosis cannot be eradicated, but it can and it will be done, especially in domestic animals, if we keep up the fight. We have it to do. (Applause)

Anthrax

I am going after a different kind of disease, just a little bit different than either of these. I just want to say a few words about anthrax, because it gives a type that is entirely different from these two types. That is a more difficult germ to kill. There is going to be no difficulty about our stamping out and

destroying all the cattle that have anthrax if we get after it, but there is going to be the most difficulty in destroying that germ in the soil and the infected places because it is a peculiar germ in spore formation that lives a long time, how long we don't know. I have in my laboratory some dried blood that was collected in Mississippi in 1889. We use that dried blood to secure our cultures of anthrax every year in the laboratory for just about forty years. That, of course, is blood protected in a hermetically sealed bottle, but how long does it live over on the deltas of the Mississippi? Have we ever worked it? No. We don't know a lot about it. Oh, you say up in the laboratory it will do so-and-so. I want to tell you out in the field it is different from the laboratory and you don't know a lot about this field condition. Some of you laboratory men rather make me tired once in a while when you tell me how to annihilate anthrax.

Quarantine vs Vaccination

I have been in the laboratory and I have been in the field now for I don't want to tell you how long, but it is a long time. I had outbreaks of anthrax in my state, and I want to tell you it comes right down to this question of destruction of the cause. I had a whole township infected with anthrax from buzzards from Mississippi. It was a range country, and everybody said, "When you have that, that is the end of it with you; you are going to have it all over your state." If I had listened to some of you laboratory men and some of the veterinarians in my state who wanted to do a little commercial work down there, we would have it yet. The first thing I did was to put a quarantine on it. I wouldn't let a veterinarian go in there and give vaccines. God knows we have spread more anthrax with vaccines than we ever got rid of in this country. (Laughter) Don't get mad at me if you don't agree with me. To prove what you have got to do, I fought on the firing line, and what did I do? We haven't had an anthrax case in that territory since. I can take you there and show it to you. I wouldn't let a man go in there and vaccinate. I put range riders in there, and if a cow died, we didn't let a dog or any animal get to her until we burned her. That was seven or eight years ago and we haven't had a case of anthrax in that territory since. I don't say it is gone; I don't know. But it wouldn't have been gone if I had let them go in there and apply a palliative treatment and let them die and let the buzzards and dogs carry it over and plant it. I don't say we got rid of it, but

we did certainly wipe out a lot of it or we would have had more of it show up at this time. That is what we want, sensible methods that work in the field as well as in the laboratory.

I would not talk this way to you but you know I am no spring chicken any more and maybe this is the last time I will get to shoot at you and I am going to hit you good and hard. (Applause) And mark you, I don't say that we are not doing anything to control anthrax in the South. The states are working very well with the conditions, and I am going to tell you a little, as the Doctor said this morning, about political influences. I have a little on infectious abortion, but I will leave that and print it with some other points. The time is rather short and I am not going to bother you with that because it is a live wire right here and we hardly know about some of it, enough for me to discuss it. I will leave these experts to tell you more about it than I can.

Just a word about poultry diseases. We have just taken up this poultry question, and when we took it up, I went over the field pretty well on literature and the pathology of poultry, and the first thing I said to myself was, "If I am going to do anything in live stock sanitary work in the way of controlling, preventing and eradicating poultry disease I have got to know more about it." That is the first thing I said. Now why? Because nearly all of the pathology and a lot of the etiology of poultry diseases have been worked up and have been written up by men who didn't know pathology. Yesterday in the research work, men read pathological work that had never been put out before on some things that we thought we knew. I said to myself when I took this thing up, "In the state of Alabama we have got to know more," and it is coming out just as I anticipated. The research veterinarians have got to work over the pathology of poultry diseases, the causes of poultry diseases, and where these poultry germs and other things live, before we can eradicate poultry diseases.

No Avian Tuberculosis in Alabama

We made a good start in bacillary white diarrhea. We made a good start in tuberculosis of poultry. Let me say just a word about tuberculosis. It is a funny thing to me that when I want to give a demonstration at our short course for veterinarians in Alabama, I have to send to Illinois or somewhere else to get birds to give demonstrations. As far as I know, I haven't seen a tuberculous chicken in the State that was not imported into

the State. Isn't that remarkable? What does that? I don't know, but it is true.

Now there is a problem. Some of you fellows who don't get out in the field as I do and go back and forth from laboratory to field, don't see these things. Every once in a while somebody says to me, "Why, you are not doing the right thing. You are dean of a college, State Veterinarian, and too many things." I want to tell you this: I will stack my state up against any of them right now. (Laughter and applause)

I am not going to tell you the good and bad things about this white diarrhea disease and tuberculosis in chickens because we haven't any of them. I am not coming up here to tell you what to do. It is your problem and my problem. The first thing you know I am going to stick a quarantine on all you people up here. (Laughter) When they had foot-and-mouth disease in Texas, I stuck a state-wide quarantine on Texas and said they couldn't take anything out of the State. Everything was under embargo. Some little fellow in Texas who had cotton and oil out there wanted to know what I meant by everything. I wired him back and told him to go to the dictionary and find out. (Laughter)

Let me talk about a different kind of disease than what I have already talked about. I want to say just a few words about hog cholera. We have that and you have that. So far as I know it is about as widely distributed, probably more so, as tuberculosis, especially in hogs. I have no fight to make on what has been done. I say the anti-hog cholera serum discovery and the double treatment was one of the greatest things ever done. Let's look it squarely in the face. Have we eradicated hog cholera?

Hog Cholera

It is a filtrable virus. We know it is in the hog. Where else do we know it lives? Has anybody found it definitely anywhere else but in the hog, in any of the other animals? Why does it come in the same old way that it came before we got hog cholera serum and virus? There is a problem. I honor the men who have gone as far as they have and I believe it is a great work, but has it brought what we ought to get and has it eradicated hog cholera? Just look over your own field. You needn't take what I say. We haven't eradicated it. It still comes in waves. It is one of these filtrable viruses.

Dr. Kegel said something about smallpox. You may not have as much of this history as I have. I am not a human physician but I know something about smallpox. If you lived in the nigger country like I do, you would know something about it. (Laughter) Jenner, way over a hundred years ago, discovered cow pox vaccination of men would prevent virulent smallpox in men, and they commenced to use it and they did have a lot of good just like we have done with hog cholera. They have broken up little outbreaks here and there when they have run their course and probably stopped the immediate infection in a way. Just as he said about this disease of typhoid out there, when they dropped the bars or let down the sanitary requirements, the cleanliness, the care of milk, typhoid came back. When we in the South don't look after the negro and he gets filthy and dirty and under bad conditions, he gets smallpox just as he always did. Have we annihilated smallpox? We haven't annihilated smallpox, we haven't eradicated it; in all these hundred years or more, the human physicians haven't eradicated it. Now why? Because they don't know enough about where this smallpox virus or cow pox virus lives. They say it lives only in the animals, but how do they keep it up all the time? How does it come about when we have a looseness in sanitary requirements? In other words we don't know all about it. And I want to drop this remark: Vaccination never eradicated a disease except temporarily. Write that in the history if you want to. It never has done it. Let's go to a few others of this kind.

Foot-and-Mouth Disease

Just take foot-and-mouth disease caused by a filtrable virus. What has Germany been doing and some of those European countries? They have been trying all kinds of sanitary treatment. Some of them projected vaccination. Have they got rid of it? Doesn't it come out there in cycles and waves? How did we get rid of it? By the stamping-out method, by getting rid of and destroying all the animals and every bit of the infection. That is the only way. We never controlled it by laws to amount to anything. The fact of the matter is, one time down in Texas one uncontrollable Texan said they wouldn't let him do it. Judges got out an injunction against getting rid of foot-and-mouth disease. They had to dissolve that in about a week and they went on and got rid of it. It took two trips to do it, but they did it. How did they do it? By the stamping-out method. They

didn't do it by vaccination. We sent a commission over to Europe to discover some method of vaccination or what not, I don't know. I said, "I hope to God they never find out a method of vaccination." (Laughter) I just want to look these fairly in the face because you are live stock sanitarians. What have you got to do? Some things you can only control. Some things you can only slightly prevent. There are a lot of diseases you can destroy and eradicate. That is the end of our work, eradication. I don't say it can be done in all these things, because it cannot.

Probably you have heard enough of my individual experience and ideas of what we are going to do. How are you going to do them? I don't know, but that is one of our problems, to find out, and I am a little bit tired of laboratory men sitting up in the laboratory and telling me just how to eradicate disease in the field. (Laughter) I am not opposed to laboratory work, and they are good workers and they are the kind of men we want and we want a lot of good ones. I just tell you this: All honor to Dr. Theobald Smith for discovering the cause and the carrier of tick fever, but if we had listened to Dr. Cooper Curtice or Dr. Smith in the eradication, we would have been about where we started. They didn't know how to handle this in the field. In all my experience I have never worked in a country in any year where we did not get something new that worked better and faster than anything we had ever had before. That was taught to us by experience. You know Patrick Henry, when he made his famous speech in St. John's Church, said, "The greatest light of the world is the light of experience." We have an idea the laboratory man can furnish us everything. I have no fight with him at all, not a bit.

Let us get clearly in mind immunization is a temporary makeshift that we use when we don't know what else to do. (Laughter) You go after it when you haven't got anything else because you have got to earn your salary. (Laughter)

I have a few words of advice to this Association, and some words to the live stock sanitary men. First I am going to pay my respects to the politician who interferes with live stock sanitary work. (Laughter)

Separate Sanitary Work from Politics

This is what we want: Separation of live stock sanitary work from federal, state, county and local politics. Every sanitarian who has had field experience knows that politics has made the

work of control, prevention and eradication of animal diseases cost more, take more time, than any other public or private factor. I studied this statement, and I make it and am going to have it printed in the report so you can read it. I am not referring to any criticisms on this state when I give you a notice of what has occurred in tick eradication. One state in the South, since tick eradication has begun, has spent $20,000,000 and has but one or two counties clean of ticks. That has not been the fault of the workers or the government workers. No! It has been the fault of the politicians who interfered with the work, and they are about where they were when they started. Think of a state spending $20,000,000 and having got nowhere. I am not criticizing anybody. These are the conditions there. Isn't that enough to indict a political machine that obstructs good work like that?

Just a word about what the Doctor spoke of this morning, human sanitary control. We have all the advantages of them in the world. They are obliged to take palliative measures once in a while because they can't kill a man to get rid of the disease. They are obliged to take these temporary acts because they can't kill all the children when they get diphtheria. Have they annihilated that disease? The other day right down in my town the doctor had a bacteriological examination of the child's mouth and it had diphtheria. Everybody said, "You oughtn't to have that. What is the matter? Eradicate it." I said, "That is not my work, that is the physician's work." But that shows you that some of these emergency methods, palliative methods, to get by, don't get at the source of the cause. In human medicine they cannot control quarantines like we do. Human people won't stand for quarantine. You can't put them within a fence or a house and lock them up, unless they are in the penitentiary. But they get by somehow.

I am not here to knock human physicians, but I want to mention this fact to you: You hear about this great eradication of mosquitoes. If it were not for the screens, the improved houses, the drainage, and the clean-up, we would be eaten up in the South with mosquitoes. They talk about eradicating them. I don't know anything about the yellow fever. They have done a good deal of good work; I don't say they haven't. But pouring oil on the water is a mighty defective method of getting rid of the mosquitoes in our territory. I don't know about Chicago, but it doesn't work with us. It doesn't get rid of them. Putting

mosquito-killing minerals in the water doesn't do much good. Drainage and cleanliness are the greatest things in the world to get rid of mosquitoes, as well as all filth diseases.

The Influence of Politics

How are you going to eliminate politics from the State Board and from the Federal Department? Somebody said they haven't got it up there. I don't know what they have in Washington if they don't have some of it. I am not saying it affects the animal industry department more than others. I have seen some times when they had some influence on the Secretary of Agriculture somehow or other. I don't know how it came about, but it was there. It permeates the make-up of politics from Washington down. That is what it does. You need not tell me that it doesn't, because it does. That is its influence. If you can get live stock sanitary men so placed that they are entirely without the sphere of the politicians, you have the best results in the world if you have good men to work it.

I want to say one thing about the states that change state veterinarians every year and sometimes twice a year. (Laughter) How do you expect a state veterinarian to learn anything about his business in a year or two years? He would hardly get the A B C of it in four years, and most of you change state veterinarians every time you get a new governor. How you can eliminate that I can't tell you; that is your work, but let this Association take that problem up to see if we can't get the sanitarian outside the control of politicians so he can be honest. You know they won't hardly let him be honest if he wants to. I have seen so much of it, and have had so much fight about it myself, especially all along the lower lines of the politicians in my State. I have one county which is the last county in the state that has ticks in it. I have had them in the Supreme Court four times. Every time I whip them in the Supreme Court they take an appeal. I am going to fight them if it takes all summer. (Laughter)

Now a few more suggestions. I am not giving you any panacea for political eradication. (Laughter) I am just telling you about a few things that I think we could work out. The old subject of standardization and uniform laws has been discussed and I am not going to take that up. I just suggest that we look that matter over.

Conversation ad Libitum

Just a word about this Association. I have been this year the head of this Association, and one year I spent at the head of the American Veterinary Medical Association. I want to say a few words about the work of these associations. They are both very much alike in some things. They have some defects. The greatest defect about both organizations is they have top-heavy, overloaded deadwood in committees. What do I mean by that? You have a committee with seven, eight, ten or fifteen on it, and when they get together they talk. Most of you have never been in a faculty meeting in a college, have you? It would remind you sometimes of a lot of old women in a sewing circle. (Laughter) They talk, talk, talk, and get nowhere. Each committee with six or eight members has at least five to six that are dead timber. Three men on a committee can do all the work and do it better than a dozen. I have found this out from experience. I sit in with the committees sometimes in an organization, and by George, I can't get in a word edgeways. They talk and talk and do nothing. When you push them for activity, they say, "Let's wait for some other day."

Let's correct that in this organization. Let's cut down this committee work. Then if a committee has to travel anywhere you don't have a lot of extra expense to be carrying this big committee around doing something that you get nowhere with. I believe that is a vital thing of interest. I will admit when you appoint three men on a committee you are going to be more careful about appointing them. You are going to appoint good men; if you don't, you will be responsible for them.

Just another word about this organization. I hate to make some of these suggestions, but as I told you, this is the last time I am going to shoot at you. The name of this Association should be changed, just the same as the American Veterinary Medical Association. Why? It is no longer a United States association, in fact it is an American association. Why not say so? That is obvious. It needs no discussion at all. We ought to have it called "The American Live Stock Sanitary Association," just the same as the American Veterinary Medical Association changed its name years ago from the United States Veterinary Medical Association. That is consistent.

One more, and I will have done. Some may not like what I have to say here, but nevertheless I feel it is my duty to say it.

Remember, in saying this I have no fight on any class of people or anybody else, but I have come to this conclusion through years of experience in handling these products and that is this: The potency, real value and standardization of biological products should be more rigidly controlled and regulated so as to protect the houses that make them and also the public that uses them.

I thank you, gentlemen. (Applause)

PRESIDENT CARY: The next thing on the program is the report of the Secretary-Treasurer, Dr. Dyson. (Applause)

SECRETARY DYSON: I have nothing at this time except the financial statement.

FINANCIAL STATEMENT

Receipts		Disbursements	
Membership dues 388 @ $2.00	$ 776.00	Printing 1927 reports(1100)	$ 499.82
State memberships 31 (see list) @ $25.00	775.00	Stenographic report	122.53
Reports sold	188.00	Postage	87.43
Interest on U. S. Bonds and Treasury Certificates	88.75	Tuberculosis Committee expense	92.00
TOTAL RECEIPTS	$1827.75	Nutritional Committee expense	3.81
1927 Cash Balance	137.14	Tick Eradication Committee expense	5.81
1929 Prepaid memberships	37.00	Clerical hire	50.00
		Containers for reports	24.25
		Express	10.58
		Telegrams	11.61
		Typing committee report	.75
		Exchange	.20
		Printing and stationery	41.65
		Circular letters	3.85
		TOTAL COST OF MEETING	$ 954.29
		Investment—Five $100 U. S. Bonds	525.70
		Cash Balance, December 1, 1928	521.90
	$2001.89		$2001.89

CURRENT ASSETS—	U. S. Treasury Certificates	$2000.00
	U. S. Bonds	500.00
	Cash Balance in Bank	521.90
		$3121.90

LIABILITIES—None.

STATE MEMBERSHIPS

Alabama	Iowa	Nebraska	Oklahoma
California	Kansas	New Hampshire	Pennsylvania
Colorado	Kentucky	New Jersey	Texas
Connecticut	Maryland	New York	Utah
Florida	Minnesota	North Carolina	Vermont
Georgia	Massachusetts	Nevada	Virginia
Illinois	Mississippi	North Dakota	Wisconsin
Indiana	Montana	Ohio	

U. S. Bureau of Animal Industry
Canadian Department of Agriculture

President Cary: Gentlemen, you have heard the financial report of the Secretary-Treasurer. What shall we do with it?

. . . It was moved, seconded and carried that the report as read be adopted. . . .

. . . President Cary made announcements. . . .

. . . The meeting adjourned at 11:40 a. m. . . .

ADJOURNMENT.

WEDNESDAY AFTERNOON, DECEMBER 5, 1928

The second session was called to order at 1:30 p. m., by President Cary.

President Cary: We have for this afternoon a very important program, especially the first part, on swine diseases. I do not know a man in the house who is not interested or ought not to be interested in this program. I want to tell the speakers that we are so short of time that I will have to hold every one of them to the limit of twenty minutes, and the discussion of each paper to ten minutes. Do not encroach on this time any more than is absolutely necessary. Take the time allotted to you and try to finish your subject.

The first paper will be "Studies of Swine Flu," by Dr. C. N. McBryde, Bureau of Animal Industry, Ames, Iowa. Dr. McBryde. (Applause)

. . . Dr. McBryde read his paper on "Studies of Swine Flu." . . .

(The paper read by Dr. McBryde was largely a compilation, with some additions, of two articles on the subject of hog flu which have already been published in the Journal. The first of these articles was entitled "Some Observations on Hog Flu and Its Seasonal Prevalence in Iowa," which appeared in the Journal, June, 1927. The other was entitled "Investigations on the Transmission and Etiology of Hog Flu," which appeared in the Journal, July, 1928. The reader is referred to these two previously published articles. Editor.)

Dr. A. T. Kinsley: Dr. McBryde's paper is particularly interesting to most of us out in the Corn Belt. About two years ago we obtained many specimens, from different sections of the country, of a condition we designated as pulmonary edema in swine. From those lungs Dr. Ray was successful in obtaining, in a large percentage, I can't tell you just the percentage, an organism of the same description that Dr. McBryde has described as being isolated from the flu cases and the particularly interesting thing to me is whether or not this pulmonary edema in swine, which is a non-febrile condition when it occurs as a separate entity, is in some way related to swine flu, whether it has the same association with this organism and what the significance really is. We also find the organism associated, as Dr. McBryde has said, in some instances, with the *Bacillus suisepticus* in which case there is a febrile reaction. The organisms injected back into swine do not produce a febrile disturbance but apparently a marked toxemia and ultimately the swine apparently recover.

President Cary: If there is no more discussion, we will proceed to the next paper, which is by Dr. Charles Murray, of Iowa State College, Department of Veterinary Investigation, on "Studies of Enteritis of Swine." Dr. Murray.

. . . Dr. Murray read his paper entitled, "Studies of Enteritis of Swine." . . .

(The paper read by Dr. Murray was practically the same as the one presented at the 1928 meeting of the American Veterinary Medical Association, in Minneapolis. This was published in the Journal, February, 1929, as the third paper of a series entitled "Studies in Infectious Enteritis in Swine." The reader is referred to this paper and the two previously published. Editor.)

President Cary: We will go on to the next paper, "Post-Vaccination Trouble," by Dr. E. A. Cahill, of Indianapolis. (Applause)

. . . Dr. Cahill read his paper. . . .

POST-VACCINATION TROUBLE—A POSSIBLE DIAGNOSTIC METHOD

By E. A. Cahill, *Indianapolis, Ind.*

The status of swine diseases has changed considerably during the past several months and we are gradually developing a much clearer and a much more practical perspective of this subject, which has been exceedingly troublesome alike to sanitary officials and to practitioners. The clearer understanding which is now in process of development is due largely to the veterinary scientists who have given unstintingly of their skill and efforts in the study of certain diseases. The work of Murray, on necrotic enteritis,[1] McBryde and Niles,[2] on "flu," and Whiting, on swine dysentery,[3] are outstanding examples of the type of research which has been in progress. These and other investigators have more or less definitely established the existence of specific diseases other than cholera and in so doing have paved the way for additional studies and more practical diagnostic methods.

While it is not yet possible to predict all of the benefits which will follow the identification of these diseases, there is one extremely important result which in itself would justify the work which has been done and repay the investigators. For years too numerous to be creditable, there has been a general belief that any acute infection of swine in this country could be diagnosed as cholera because other acute diseases rarely or never occurred except as a complication of cholera. This belief, challenged by some but accepted by many, has seriously handicapped the control of swine diseases. Now that its fallacy has been established, it is incumbent on those who are entrusted with the responsibility of disease prevention and control to liberalize their views and recognize those diseases which have been identified, as well as other troublesome conditions which exist but which are not yet well understood.

For a number of years one of our most serious problems has been the condition which has become known as post-vaccination trouble. Our failure to devote to this problem the study which it deserves and our tendency lightly to diagnose cholera and recommend re-vaccination, constitutes a serious indictment against our rights to the guardianship of the animal industry. When the owner of swine has his animals vaccinated against cholera he does so because he desires protection against disease and because he

has confidence in the simultaneous treatment. If and when such animals subsequently become sick, the owner feels that he has made a poor investment, his confidence in a valuable immunizing procedure is destroyed, and his failure to vaccinate regularly thereafter increases the number of susceptible animals and the danger of epizootics. The serum and virus which was used on his animals was produced and tested under governmental supervision and in all probability was used in scores of other herds with entirely satisfactory results. If a state or federal representative called in consultation merely diagnoses cholera and advises re-treatment, the situation is not improved nor is the owner's confidence restored. The practicing veterinarian or the sanitary consultant should be, and some are, able to analyze the situation, explain the cause for the trouble and offer suggestions which will prevent a recurrence of the condition. Only by such a procedure can the owner be placated and his confidence in vaccination restored. To bring about the needed improvement in this respect two developments are essential.

1. The field representatives of sanitary organizations should no longer maintain the attitude that all post-vaccination trouble is cholera, per se. They and their superiors should liberalize their views and field activities in accord with conditions which now exist.

2. Efforts should be made to interest our veterinary scientists in this problem and their abilities and efforts should be devoted to a study of all of the factors responsible for this serious condition.

For many years I have been convinced that most of the errors pertaining to post-vaccination trouble are due to the failure to appreciate properly the true significance and meaning of petechiae which are observed on autopsy. In such cases the two following facts are frequently ignored:

1. Petechiae are normally present for two to three weeks following vaccination, even though the animals are not sick and show no visible reaction. Therefore, if the vaccinated animals are haboring chronic lesions and become visibly sick because virus is superimposed on a pre-existing condition, the problem becomes one of detecting the chronic lesions rather than overestimating the significance of the petechiae which are and should be present following the recent vaccination.

2. A fact which is not generally appreciated is that hog cholera cannot be diagnosed merely because petechiae are present.

Petechiae are hemorrhagic extravasations and indicate a septicemia, a toxemia, or the existence of some other foreign substance which is injurious to the normal defensive mechanism of the body. It is true that petechiae are generally present in cholera-sick animals but they may be present also in animals which are not harboring hog cholera virus but are affected with some other pathological condition. Therefore, when autopsy reveals the presence of petechiae our professional ability must be exercised to determine whether we are dealing with uncomplicated hog cholera, with cholera and some other disease in combination, or with some other pathological condition to the exclusion of cholera.

These statements are borne out by investigations which were made by the writer a number of years ago. This work was conducted to determine the degree of dependability which could be attached to petechiae as a diagnostic lesion and to determine the percentage of post-vaccination trouble cases which really were hog cholera. The results of these investigations were presented in two papers, the first published in the November, 1923, issue of the JOURNAL of the American Veterinary Medical Association[4] and the second presented to this Association in December, 1923.[5]

Our experimentation was conducted by inoculating into susceptible swine, the blood of animals which had sickened subsequently to vaccination. In each instance one or more veterinarians believed the trouble to be cholera while others believed it not to be. In every instance the animal whose blood was selected for inoculation showed extensive petechiation on autopsy.

The 253 herds selected for study were divided into two groups. The first consisted of those in which sickness developed within thirty days following vaccination, the second represented herds in which sickness appeared more than thirty days after vaccination. In each herd the blood of one or more typical cases was selected and after proper laboratory preparation was injected into susceptible swine.

In the first group, where animals sickened within thirty days after vaccination, there were 183 herds. Of these, 144 (72.2%) proved negative to cholera. In the group where sickness developed later than thirty days after vaccination there were 70 herds. Of these, 46 (63.9%) proved negative for cholera when susceptible swine were inoculated.

While these findings substantiated the belief that most post-vaccination trouble is not cholera, it also clearly indicated that

petechiae cannot be considered a positive diagnostic lesion of cholera. The literature is replete with evidence to discredit those who believe that a diagnosis of cholera is justified by the detection of petechiae, but new evidence has recently been furnished by Pickens[6] and his collaborators. These investigators report their inability to demonstrate the presence of virus in the blood of pigs which on autopsy showed the petechiae formerly considered diagnostic of cholera.

The accurate diagnosis of cholera can be arrived at only by the inoculation of susceptible pigs with blood from suspected cases but this is an expensive procedure and requires a number of days. There is, therefore, a great need for a dependable diagnostic method without the disadvantages of animal inoculation.

We were impressed with the possibility of chemical or pathological changes in the blood of affected animals which might lead to a rapid and practical diagnostic method. The literature reveals considerably less work on the blood of animals and particularly swine than in the case of the human. However, Dinwiddie,[7] in 1914, published a most comprehensive article on this subject which apparently has failed to obtain the amount of attention which it deserves. He describes in great detail a physiological study of the blood of normal pigs and of the pathological changes which occur in the blood of those affected with cholera, calling particular attention to the leukopenia which regularly occurred in cholera-sick animals. More recently Shope,[8] of the Rockefeller Institute, in addressing the Eastern Iowa Veterinary Medical Association, is said to have reported this same leukopenia.*

Feeling that the possibility of a diagnosis by this means justified thorough investigation, the writer, in collaboration with associates, has attempted to corroborate and extend the work previously conducted. We are afforded an excellent opportunity of studying the leukocytic count of animals in serum and virus production; including healthy, unvaccinated pigs, cholera-sick animals, those recently vaccinated, those vaccinated for several weeks, and also heavy, healthy hogs before and after they are hyperimmunized against cholera.

I am presenting herewith only a summary of our findings to date. Data, references and an acknowledgment to my collaborators are attached hereto.

*Vide "The Study of the Cells of the Blood as an Aid to the Diagnosis of Hog Cholera," by Paul A. Lewis and Richard E. Shope, in the January, 1929, issue of the JOURNAL.

First, we attempted to determine the normal leukocytic count of healthy, cholera-susceptible pigs. We found this to vary from 10,300 to 16,600 leukocytes per cubic millimeter, with an average of 13,600. This figure is somewhat lower than that reported by Kohanawa. This author, as reported by the *Veterinary Record*, of October 6, 1928, obtained an average count of 20,620. Dinwiddie, on the other hand, shows an average count of 11,800. We believe that this variation is not important, in view of the marked difference between these figures and the count which is observed in the case of cholera-sick animals. Variations in technic might easily account for the difference in results.

We next attempted to obtain a picture of just what happened to the leukocytic count in the blood of pigs which were inoculated with hog cholera virus in routine virus-production work. It was found that, whereas the average count before inoculation was 13,600 per cu. mm., a diminution was observable very shortly after injection. Within 24 hours the average count had decreased to 4400 leukocytes per cu. mm. From this point until the animals died or were destroyed there was a progressive leukocytopenia. The leukocytes were counted twice each day and although there was revealed some slight variation, the count at no time exceeded 5100 and this gradually decreased until just prior to death, when the count ranged from 600 to 2200, with an average of 1596 per cu. m.m Again our figures are somewhat at variance with those of Dinwiddie, since his average count was 6300. If, however, two of his atypical cases are omitted from consideration, his average is reduced to 4700. While the leukocytopenia which we observed was greater than that recorded by Dinwiddie, it is quite possible that the different methods used in collecting and examining the blood accounts for the variation.

Since we had in a general way corroborated Dinwiddie's findings, it seemed advisable to learn whether a leukocytopenia would be produced by bacterial infection. Consequently, two pigs were inoculated with pure cultures of *Bact. paratyphosum*. Within twelve hours their leukocytes had dropped to 6800 per cu. mm. In twenty-four hours the count of one animal was 2400. At this point leukocytosis occurred and from the thirty-sixth hour until the end of the eighth day the count ranged from 19,000 to 11,000. During all of this time the animal was very sick and was destroyed at the end of the eighth day for autopsy. The second pig, at the end of twenty-four hours, showed a count of 20,000 and from this point until the end of the fifth day the number of leukocytes

gradually decreased to 7500. At this point death occurred. It is interesting to note that this picture is considerably different from that which occurred in the case of cholera-sick animals. In our bacterial infection we had first a leukocytosis followed by a diminution in leukocytes which was rapid but which never reached the low count shown by cholera-sick animals. Of equal interest is the fact that the extensive petechiation which each of these pigs showed on autopsy might have permitted an erroneous diagnosis of hog cholera.

Next, two pigs were inoculated with the buffalo strain of the hemorrhagic septicemia organism. In twelve hours the counts had been reduced from the normal average of 13,600 to 6800. Then, as in the case of the pigs which were injected with *Bact. paratyphosum*, a leukocytosis occurred. In thirty-six hours one animal showed a count of 21,000 and the other 30,000.

From this point there was a very rapid leukocytopenia. One animal died on the second day, showing a count of 4200. The second animal died on the fourth day, showing a count of 6300.

In view of the information thus far obtained it seemed desirable to obtain a picture of the leukocytic reaction following the administration of the simultaneous treatment. Two healthy pigs were given the ordinary dose of serum and virus. The following day the leukocytic count had been reduced to 7300 and 4400 respectively. After twenty-four hours the decrease ceased and a gradual leukocytosis occurred until at the end of the eighth day both animals showed a count of 14,000 per cu. mm.

It appeared at this stage that there was considerable justification for the belief that whereas a leukocytopenia might develop following hemorrhagic septicemia or paratyphoid infection, the diminution in the number of leukocytes would not be nearly so great as in the case of hog cholera and that this fact could be utilized for diagnostic purposes as proposed by others. With this in mind we procured samples of blood from two herds which had become sick after vaccination. It was believed that the trouble in the first herd was not hog cholera and that the trouble in the second herd was hog cholera. Blood from animals in each herd was subjected to bacteriological examination with negative results. It was then filtered and two susceptible pigs were injected with each sample. The pigs injected with blood from the herd which we thought did not have cholera, remained healthy although their susceptibility was later proved.

The blood from animals in the herd in which cholera was suspected was injected into two litter mates of those used in the above-mentioned test. These animals became sick on the sixth day. The symptoms and autopsy findings were typical of hog cholera. However, their temperatures were at no time as high as we ordinarily observe in pigs inoculated with virus. The day these animals died the leukocytic counts were 16,000 and 18,000 respectively, instead of approximately 1700 as was expected. From the lungs and spleen of these animals *Pasteurella suiseptica* was recovered.

The failure of these animals to develop a leukocytopenia in view of what clinically appeared to be cholera raises in our minds a number of questions which, in view of the limited time at our disposal, it is not possible to discuss. Two, however, are so obvious that they deserve mention:

1. If our clinical diagnosis was correct, why was not the leukocytic count in keeping with that previously observed in the presence of virus infection?

2. Assuming that in uncomplicated cholera we can regularly demonstrate a leukopenia, is this condition changed to a leukocytosis in the case of dual infection?

It is realized that our work has been conducted on a comparatively limited number of animals and that instead of clarifying, it beclouds the issue. It is presented, therefore, without conclusion and in the hope that it will stimulate greater efforts to develop this or other methods which may make the diagnosis of cholera easier and more accurate.

Acknowledgment

The writer gratefully acknowledges the assistance which was rendered by his associates, Dr. S. H. Regenos and Dr. V. F. Saylor, under whose direction the detailed work was conducted.

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PRESIDENT CARY: We will proceed with the report of the Committee on Swine Diseases, of which Dr. Murray is chairman.

DR. MURRAY: I want to make this explanation, which I believe is proper, since the reading of the last paper. There was no dead timber on our Committee, but your chairman is responsible for practically all that is said here and concurrence of the other members of the Committee was had by submitting the report to them. Some of the things said in this report sound so much like what Dr. Cahill gave that I really feared you would think we were in collusion. I did not know what he was doing in the way of a paper and what I say, I believe, is the opinion of all members of the Committee, all of whom have been consulted or have received copies of this report.

. . . Dr. Murray read the report of the Committee on Swine Diseases. . . .

REPORT OF COMMITTEE ON SWINE DISEASES

DR. CHAS. MURRAY, *Chairman*, Ames, Iowa.

Dr. M. Dorset, Washington, D. C. Dr. E. A. Cahill, Indianapolis, Ind.
Dr. J. W. Connaway, Columbia, Mo. Dr. W. B. Niles, Ames, Iowa.

The situation in respect to the occurrence of swine diseases shows some few changes the past year in comparison with the year preceding. There is forced upon us the conclusion that while hog cholera is of no less importance, other diseases are of increasing importance, both as regards their effect per se and their influence upon immunization against hog cholera. There are reports of fewer cases of post-vaccination trouble than last year and fewer outbreaks of necrotic enteritis. The recognition of the importance of swine diseases other than cholera comes from all groups concerned in swine husbandry, including swine-raisers, practicing veterinarians, state and federal control officials and serum-producers. In times not so distantly past, most post-vaccination troubles were looked upon as being either serum or virus breaks and the potency of the products was invariably questioned. Today, such conditions, while still recognized, are more generally regarded as having causes other than impotent biological products.

In a recent questionnaire answered by 100 practicing veterinarians from all parts of one of our foremost hog-raising states, post-vaccination troubles are reported less common this year by 84 per cent of the correspondents. Sixteen per cent report more. Answers to the same question by a majority of the larger serum-manufacturing companies show 70 per cent reporting fewer cases of post-vaccination trouble. As indicating the causes of such trouble, 68 per cent of the veterinarians and 70 per cent of serum manufacturers report complicating diseases responsible. Twelve and one-half per cent of veterinarians and 30 per cent of manufacturers name insufficient dosage of serum as responsible. Only 2½ per cent of veterinarians ascribe the trouble to impotent serum, while 17 per cent of them and 10 per cent of manufacturers view the decrease in number of post-vaccination troubles as due to the greater discrimination exercised by veterinarians in the selection of herds for simultaneous treatment.

Of the diseases named as most important in contributing to post-vaccination troubles, necrotic enteritis ranks first according to the estimate of 42 per cent of veterinarians and 40 per cent of manufacturers. Intestinal parasites are ranked a close second and flu third by both groups. Seventy-eight per cent of veterinarians report swine-raisers of their localities using better methods of hog-raising and 100 per cent of those reporting state that the effect of these better sanitary measures is noticeable in a corresponding reduction of swine troubles. In order of importance, the swine diseases productive of losses of hogs the past season are enumerated by those answering the questionnaire as:

1. Necrotic enteritis
2. Cholera
3. Intestinal parasites
4. Flu
5. Abortion
6. Infectious rhinitis

7. Acute enteritis including pig scours
8. Mange
9. Tuberculosis

From Illinois east, a pulmonary disturbance with lesions of such chronicity as to indicate quite conclusively that the infection was present before vaccination, is reported as representing the most common post-vaccination trouble. This condition seems to contribute to post-vaccination trouble to quite the same degree as does necrotic enteritis farther west.

The effect of the bovine tuberculosis eradication work upon retentions and condemnations of swine at federal-inspected slaughter-houses is gratifying. Commissioner H. R. Smith, of Chicago, reports that condemnations of hog carcasses for tuberculosis are approximately 80 per cent less from accredited than from non-accredited counties in the same general territory, while retentions are approximately 30 per cent less. Commissioner Peck, of South St. Paul, gives figures showing 83 per cent less condemnations and 19.6 per cent less retentions for his territory. Commissioner Boyt, of Sioux City, reports 75 per cent less condemnations and 43 per cent less retentions. From the Omaha territory, as reported by Commissioner Spencer, the figures are even better, with condemnations reduced 93 per cent and retentions nearly 80 per cent. Commissioner Knilans, of Wisconsin, releases figures which show a decline of 33.7 per cent in retentions and 38.8 per cent in condemnations in market-run hogs of 1928, as compared with those of 1923, while in hogs from accredited territory the decrease in retentions is 62.7 per cent, and in condemnations, 100 per cent for the same years.

Federal reports from the Meat Inspection Division, according to Dr. A. E. Wight, Chief, Tuberculosis Eradication Division, indicate that tuberculosis among swine is decreasing. In the year 1924, 15.2 per cent of all hogs slaughtered under federal supervision were retained on account of tuberculosis; while in 1928 the percentage of retentions was reduced to 12.1, or a reduction of 20.4 per cent. In 1924, 1.2 per cent of all retained hogs were condemned; while in 1928 this percentage was reduced to 0.95, or a reduction of 20.8 per cent.

The research work on swine diseases the past year offers much encouragement, pointing to ultimate solution of some of the problems of swine diseases. Much of this work is fundamental to applied treatment. Record of such work, as reported in various publications, comes from:

I. U. S. Department of Agriculture
  1. Biochemic Division
    (a) Investigations on transmission and etiology of hog flu.
  2. Zoological Division
    (a) Studies of losses through condemnations due to parasites.
    (b) Effect of swine sanitation in control of kidney worms.

II. Department of Veterinary Science, Purdue University
    (a) Anemia in young pigs.
    (b) Swine dysentery.

III. Veterinary Investigation, Iowa State College
    (a) Studies of infectious enteritis.
    (b) Vulvovaginitis.

IV. Department of Animal Pathology, Rockefeller Institute for Medical Research
    (a) Study of the cells of the blood as an aid to the diagnosis of hog cholera.

V. Department of Veterinary Science, University of Missouri
    (a) Abortion in swine.

VI. Department of Bacteriology and Sanitation, University of Maryland
    (a) Susceptibility of suckling pigs to hog cholera.

PRESIDENT CARY: What shall we do with this report?

DR. C. P. FITCH: I move that we accept the report of the Committee.

. . . The motion was seconded and carried. . . .

PRESIDENT CARY: Is there any further discussion?

Dr. J. W. Connaway: I had hoped that Dr. Cahill in his work would not close it just as he did. That is, he said that it simply beclouds the issue, in regard to these post-vaccination troubles. That throws us back to where we were, except to bring out the fact that we do have other things than hog cholera, which I think is very important in our further handling of hog troubles. But, we have got hog cholera to deal with in a practical way. We must vaccinate and we have vaccination troubles and will continue to have them. The question is, what shall we do when a vaccination trouble arises? Shall we give the owner of these hogs and the veterinarian who is unfortunate enough to have these troubles an alibi that will not satisfy and leave this man's hogs to die? We can't do that. We must rely on those old pathological points that Dr. Law and Dr. Salmon found in work forty or fifty years ago, certain things that we now regard as the practical signs of hog cholera. These things are beautifully illustrated in some of those very old publications. I say that when any veterinarian finds these petechiated kidneys and hemorrhages in the bladder, it is his business to revaccinate that herd. Just before I came away to this meeting, a veterinarian up mid-state had vaccinated a bunch of hogs. He had done more than that, he had vaccinated them with some bacterins prior to vaccinating for hog cholera. These animals were supposed to be healthy at the time of vaccination. Later on they came down with something that looked like hog cholera. But the veterinarian and a representative from the serum company that came there and looked over the situation decided that it was not cholera. The local veterinarian was not satisfied, and sent down a couple of pigs to our laboratory to have an unbiased examination made (of course we are always unbiased at the experiment stations) to see what this was. We found in both of these animals (my friend Dr. Crisler found it) all of those signs that we have been calling hog cholera for years and years, and we advised revaccination of that herd and we believe that the man who was sent there by the company ought to have advised exactly what we did. Now by saying this I don't mean to say that that company's serum was at fault, nor that the virus may be at fault, though I think the probabilities in this case are that the virus was at fault. I think when that serum was liberated from that company for use in the field, it was probably as good as any that could be made, but we know from experiments which we have made in our station that the virus in those hogs remains living for at least two or three weeks, and any untoward circumstance or condition to which these animals may be exposed during that period may bring down some of these animals with acute hog cholera. The sensible thing to do is to get into these animals just as much potent serum as you can. This is the practical phase of this subject. (Applause)

President Cary: Gentlemen, we have quite a long program to go through with and we will close the discussion unless there is something very important to be brought out at this time. If not, we will go on to the subject of poultry diseases. The first paper will be by Dr. W. R. Hinshaw, of the Massachusetts Agricultural Experiment Station, on the subject of "Standardization of Bacillary White Diarrhea Control Methods in New England." Dr. Hinshaw.

. . . Dr. Hinshaw read his paper. . . .

STANDARDIZATION OF BACILLARY WHITE DIARRHEA CONTROL METHODS IN NEW ENGLAND

By W. R. Hinshaw, *Amherst, Massachusetts*

Department of Veterinary Science, Massachusetts Agricultural Experiment Station

One of the recommendations made by the Committee on Poultry Diseases for this association a year ago was, "That sectional meetings of men interested in bacillary white diarrhea

continue to be held for the purpose of furthering standardization of technic, manufacture of antigens, and interpretation of results. At these meetings comparative agglutination tests should be made. Autopsy of birds and a thorough study of the results obtained by each man should follow such procedure."

This recommendation suggested the plan for the New England Conference of Laboratory Workers in Bacillary White Diarrhea Control, which was held at Amherst, Massachusetts, April 24, 25 and 26, 1928. This conference was sponsored by the Department of Veterinary Science, Massachusetts Agricultural Experiment Station, and representatives from five of the six New England States invited were present.

The purpose of the conference was, "To obtain cooperation between the six New England States; to attempt standardization of laboratory methods and equipment and for the development of better fellowship among the laboratory workers of this section."

The states represented were: Connecticut, by Dr. L. F. Rettger; Maine, by Dr. F. L. Russell and Prof. E. R. Hitchner; Massachusetts, by the entire Veterinary Department staff; New Hampshire, by Dr. E. M. Gildow; and Vermont, by Prof. A. W. Lohman. Rhode Island was represented for one half-day by Dr. J. C. Weldin, but he could not take an active part in the conference due to lack of time.

Program and Plan of Conference

No program was prepared for the conference. An outline of suggested material was sent to each person invited, and each was asked to be able to present data regarding bacillary white diarrhea control in his state. Examples of material sought were: comparison of work done in 1927-28; information on methods of blood sampling; laboratory technic; equipment used; and control methods.

The plan of the conference was strictly informal. It acted as a clearing-house for mutual problems. A portion of the time was devoted to the actual laboratory work of setting up agglutination tests with antigen brought from each laboratory, and sera furnished by the Maine and Massachusetts laboratories. Without doubt these cooperative tests were conducted under as nearly ideal conditions as are possible. Individuality, and different antigens or tests fluids were the only variants, since identical methods and equipment were used. The tests were incubated in the same incubator for the same period of time. Comparisons as

to pH value, turbidity, etc., were made of each antigen used, and as much time as was available was given to studying the minor discrepancies which occurred. It might be well to mention that all the discrepancies which occurred were due to individual differences in interpretations of results.

One half-day of the conference was devoted to a joint meeting with the New England live stock sanitary officials. This joint meeting was given over to a discussion of bacillary white diarrhea control, and to standardization of methods of accreditation.

Definite progress in bacillary white diarrhea control was evident from the reports of testing given by the various laboratories. Table I summarizes the results of testing in the five New England States represented at the conference.

TABLE I.—*Summary of agglutination tests made by New England laboratories in 1927-28*

State	Flocks Tested	Tests Made	Free* Flocks	100% Tested Flocks† Total Flocks	100% Tested Flocks† Free Flocks
Connecticut.....	144	102,319	78	101	22
Maine..........	179	79,000	73	135	73
Massachusetts...	321	232,091	138	162	85
New Hampshire..	159	79,539	94	91	70
Vermont........	59	17,600	14	59	14
Totals........	862	510,549	397	548	264

*No infection for one or more years.
†Flocks where every bird on the farm has been tested. The difference between these figures and those in the other columns is the percentage of total birds on the farms. Many poultrymen test only their breeding birds, and some states require only a small percentage of negative flocks to be tested each year.

Other features of the conference were demonstrations of the equipment and apparatus used by the various laboratories represented, and discussions on such problems as handling hemolyzed samples, cloudy tests, jelled sera; proper age to start testing birds; the use of the intradermal test; and the "slide" or "rapid" method of testing. These discussions were made more interesting by demonstrations.

Three days were too short a time to settle all the problems that arose, but the real climax of the conference came when time was taken out for adoption of certain standard methods of procedure. It is impossible to describe the enthusiasm with which this group met its many problems. It was with the same spirit of cooperation and enthusiasm that a few methods were adopted to try out during the 1928-29 testing season. It is to be expected

that everyone had to give and take, but no one has been sorry for any of the various plans adopted.

The Standard Methods Adopted for the 1928-29 Testing Season

Antigens: Outstanding among the accomplishments of the group was the decision to use the same cultures for making antigens during the 1928-29 testing season.

It was agreed by all present that the antigens (test fluid) used, should be made by pooling five strains of *S. pullorum* obtained from the five states represented. Each representative has furnished his most typical, best growing, and best agglutinating strain to each of the other laboratories. These cultures were partly isolated from ovaries and partly from chicks.

Cultures for preparation of antigens are grown on solid medium made from the following formula:

Meat extract (Difco beef)	0.3%
Peptone	1.0%
Agar	1.5%
Distilled water	1000 cc

Cultures are incubated for 48 hours at 37° C. and washed off with 0.5 per cent phenolized physiological saline.

Examinations are made for purity, by appearance of culture, microscopic examination, and fermentation reactions in the presence of one per cent glucose, sucrose, maltose, and lactose media.

Stock antigens are preserved with 0.5 per cent phenol, and diluted for use to compare with the .75 tube of McFarland's nephelometer. Antigens are stored at ice-box temperature, and stock antigen is not used after it is three months old. Diluted antigens are diluted at least every two weeks.

To determine the antigenic properties, newly made antigens are tested with known positive fresh serum, or if preserved, not over one week of age. Preservatives for sera recommended were phenol or chloroform.

The test proper: A tentative agreement to accept 1-50 as the maximum dilution, with all typical reactions, partial or complete, to be considered positive. Lower dilutions were left optional, as was also the autopsy of doubtful reactors. It was generally agreed that no bird shall be recommended for accreditation which does not give a negative reaction in the 1-50 dilution.

Tests are incubated for at least 24 hours at 37° C.

Miscellaneous: To maintain a mutual agreement regarding testing and other diagnostic service for persons in other than one's home state, it was agreed that all work for such persons be referred to the proper laboratory in the state where the client resides.

It was further agreed that the certain problems be given attention by each laboratory during the year, and to make reports of progress at the next meeting.

These problems are:

(a) Use of NaOH in antigen to prevent "cloudy" reactions.

(b) Proper age at which pullets can be tested.

(c) Use of the "rapid method" for salvaging hemolyzed and "cloudy" serum samples.

(d) Proper dilutions of serum-antigen mixtures to consider diagnostic based on results of autopsy and bacteriological examination.

Conclusion

Briefly, the outcome of this conference of laboratory workers in bacillary white diarrhea control, was a mutual agreement to adopt as far as possible a standard technic which was agreed upon at the conference. No hard and fast rules were adopted, and all those agreed upon were flexible enough to allow changes another year. But, the real good that came out of this meeting was the start made towards the adoption of standard methods of control of bacillary white diarrhea. True, there were differences of opinion, but at least five groups of laboratory workers in bacillary white diarrhea control in United States now have a better understanding of each other than ever before.

Plans are already under way for a similar conference to be held at the end of the 1928-29 testing season. Instead of being confined to New England, the 1929 conference will invite all of the Northeastern States to participate.

The success of this first conference warrants our recommending this method of attacking the present situation regarding bacillary white diarrhea control.

President Cary: Are there any questions you want to ask Dr. Hinshaw? If not, we will go to the next paper, which is, "The Result of Three Years' Work in Bacillary White Diarrhea Control in Virginia," by Dr. I. D. Wilson, Department of Zoology and Animal Pathology, Virginia Polytechnic Institute, Blacksburg, Virginia.

. . . Dr. Wilson read his paper. . . . (Applause)

THE RESULT OF THREE YEARS' WORK IN WHITE DIARRHEA INFECTION CONTROL IN VIRGINIA

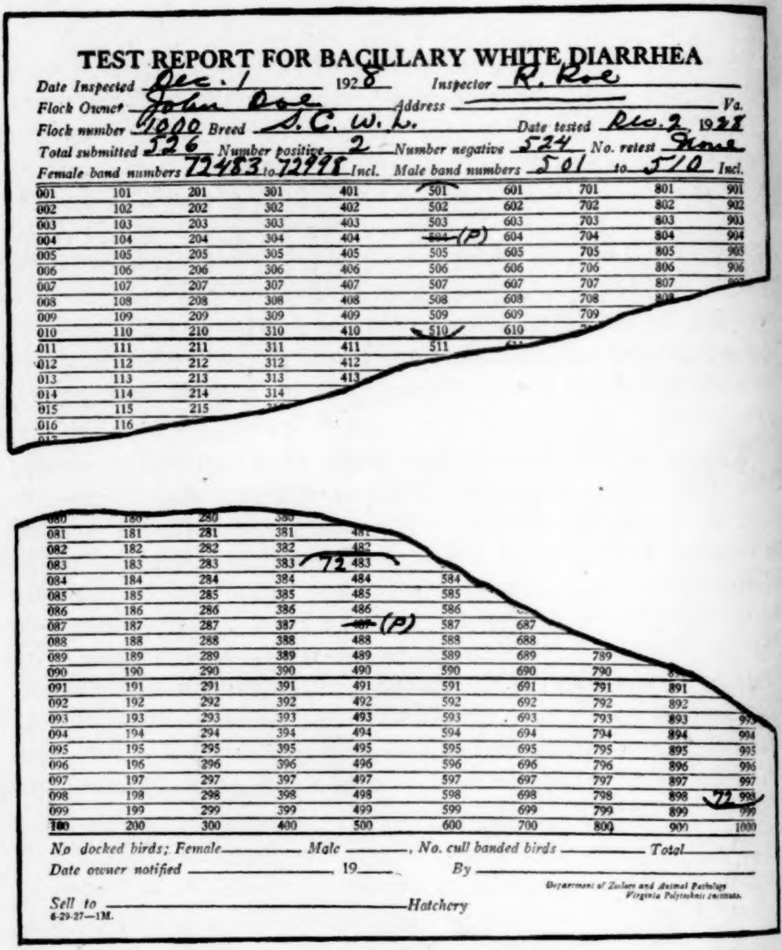
By I. D. WILSON, *Blacksburg, Virginia*

Department of Zoology and Animal Pathology, Virginia Polytechnic Institute

In 1925, in response to the urgent demands of the leading poultrymen and hatcherymen of Virginia, the State Department of Agriculture inaugurated their plan of certification and accreditation of flocks and hatcheries. Not having the proper laboratory facilities nor technically trained men, they approached the Department of Zoology and Animal Pathology of the Virginia Polytechnic Institute with the request that the latter department advise with them concerning their regulations and test the blood samples submitted by them. This accordingly was done. The laboratory and technical phases of the work were under the direction of the Head of the Department of Zoology and Animal Pathology.

During the first year, approximately 20,000 birds in something over 100 flocks were tested. During the second year the number was approximately doubled. The actual testing during the first two years was done by Dr. C. J. Coon, then a member of the Department. Last year, the third year, about 100,000 birds in 439 flocks were tested by Dr. Herman Farley. The demand for the service by poultrymen and hatcherymen having steadily increased to the point that it became burdensome to the Department of Zoology and Animal Pathology, provision was made to transfer the technical end of the work to the office of the State Veterinarian, where the work is now in progress. Part of the fourth (this) year's work is included in this report.

The blood samples for test are collected in the field in ⅜″ x 3″ tubes. It has been found that the tubes with lip, etched with an emery wheel so that they can be numbered with pencil, are most satisfactory. The birds are culled for purity of type, production, etc., and banded at the time of bleeding with sealed, serially numbered leg-bands, and the numbers indicated on report blanks printed for the purpose. The blanks used, in addition to showing the owner's name, address, flock number, date, etc., have printed on the face numbers arranged in ten columns from 001 to 1000. This blank has almost unlimited possibilities for reporting blood



TEST REPORT FOR BACILLARY WHITE DIARRHEA

Date Inspected Dec. 1 1928 Inspector R. Roe

Flock Owner John Doe Address Va.

Flock number 1000 Breed S. C. W. L. Date tested Dec. 2, 1928

Total submitted 526 Number positive 2 Number negative 524 No. retest None

Female band numbers 72483 to 72998 Incl. Male band numbers 501 to 510 Incl.

001	101	201	301	401	501	601	701	801	901
002	102	202	302	402	502	602	702	802	902
003	103	203	303	403	503	603	703	803	903
004	104	204	304	404	~~504~~ (P)	604	704	804	904
005	105	205	305	405	505	605	705	805	905
006	106	206	306	406	506	606	706	806	906
007	107	207	307	407	507	607	707	807	
008	108	208	308	408	508	608	708		
009	109	209	309	409	509	609	709		
010	110	210	310	410	510	610			
011	111	211	311	411	511				
012	112	212	312	412					
013	113	213	313	413					
014	114	214	314						
015	115	215							
016	116								

080	180	280	380						
081	181	281	381	481					
082	182	282	382	482					
083	183	283	383	72 483					
084	184	284	384	484	584				
085	185	285	385	485	585				
086	186	286	386	486	586				
087	187	287	387	~~487~~ (P)	587	687			
088	188	288	388	488	588	688			
089	189	289	389	489	589	689	789		
090	190	290	390	490	590	690	790		
091	191	291	391	491	591	691	791	891	
092	192	292	392	492	592	692	792	892	
093	193	293	393	493	593	693	793	893	993
094	194	294	394	494	594	694	794	894	994
095	195	295	395	495	595	695	795	895	995
096	196	296	396	496	596	696	796	896	996
097	197	297	397	497	597	697	797	897	997
098	198	298	398	498	598	698	798	898	72 998
099	199	299	399	499	599	699	799	899	999
100	200	300	400	500	600	700	800	900	1000

No docked birds; Female _____ *Male* _____, *No. cull banded birds* _____ *Total* _____

Date owner notified _____ 19___ *By* _____

Department of Zoology and Animal Pathology
Virginia Polytechnic Institute.

Sell to _____ *Hatchery*

6-29-27—1M.

FIG. 1. Blank form used by the Department of Zoology and Animal Pathology, Virginia Polytechnic Institute, for recording results of agglutination tests for bacillary white diarrhea.

samples because it is adaptable to a large series of numbers. No numbers are copied. The bleeder simply designates the series and indicates with a pencil mark the number of the first and last bird bled. This saves much time and makes for accuracy.

If the weather is warm, the blood samples are placed in double metal containers with ice in the outer compartment, and shipped to the laboratory. The tubes are then placed in wooden blocks bored with 110 holes (ten rows of eleven holes each.) The eleventh hole in each row is not numbered. The others are numbered consecutively from 1 to 100. The tubes when placed in the blocks are placed in the hole whose number corresponds to the digits on the tube on the right (tens). In this way, if any tubes are missing, it will be noted in the laboratory at once. Also, any figures that are not clear on the tubes can be corrected, duplications noted, etc.

If large numbers of samples are to be handled accurately, some such system as this is absolutely necessary. If the inspectors who take the blood samples are working near enough to the laboratory, the wooden blocks are taken to the field and the tubes placed directly in them and returned to the laboratory at the end of the day. This saves time and expense of packing and transfer of the tubes from the metal containers to the blocks in the laboratory.

During the first two years, the ordinary macroscopic agglutination test was employed. Since that time, the rapid method agglutination test as developed by Runnells et al.* has been employed. All doubtful samples have been retested with the ordinary agglutination test. In this way it has been found possible to cut the cost of testing to half.

At the end of the first year's work it was found that of the 18,013 birds, representing 138 flocks, tested for the first time, 2730 (15.2%) were positive to the test. Of these 138 flocks tested the first year, 93, representing 18,938 birds, were tested the second year. Of this group, 1666 (8.8%) were positive, making a reduction of 6.4%. Fifty-five of these 93 second-year flocks were tested for the third year, representing 13,073 birds, with 6.3% positive to the test, making a reduction of 2.5% over the second year, or a reduction of approximately 9% over the first year. At the date of preparation of this report, 27 of the 55 third-year flocks, representing 6406 birds, have been tested

*Vide "An Application of the Rapid-Method Agglutination Test to the Diagnosis of Bacillary White Diarrhea Infection," by Runnells et al., in the JOURNAL, February, 1927.

for the fourth time with an average of 5.1% positive, or a reduction of 1.2%. Taking the whole period into consideration, we find that on the fourth test, the 27 flocks, consisting of 6406 birds, have approximately one-third as many birds positive to the fourth test as there were to the first.

The testing being still in progress, more of the original flocks will be tested before the season ends. In evaluating these data, it is to be borne in mind that only those flocks tested every year for the period (two-, three- or four-year period) have been included. Some flock-owners have had their flocks tested once and, finding their troubles from bacillary white diarrhea relieved, have ceased testing. These flocks, if included, would have lowered the percentage of positive birds. Others finding their flocks heavily infected at the first test, have been discouraged and stopped testing.

In many cases baby chicks from untested breeding stock or untested adult birds have been added to the flocks after the hatching season, which would, of course, increase the percentage of positive birds, in the following test. It has been observed that in nearly all cases where the percentage of positive birds runs high year after year, that the sanitary conditions are bad. In practically all cases in flocks showing a marked increase of positive birds over the previous year, diligent inquiry and examination of the premises will reveal the cause.

In examining the twenty-seven flocks that have been tested four times, we find that thirteen show a regular decrease following each test, thirteen are irregular and one shows an increase over the first year, but a decrease over the second, as is shown in table I.

TABLE I—*Results in 27 flocks tested four times*

	1925 & 1926		1926 & 1927		1927 & 1928		1928 & 1929	
	Birds Tested	% Positive	Birds Tested	% Positive	Birds Tested	% Positive	Birds Tested	% Positive
13 flocks decrease	2,057	15.2	2,750	7.8	3,904	4.9	3,397	2.4
13 flocks irregular	3,679	9.2	2,487	10.6	2,828	7.1	2,750	8.4
1 flock increase	426	0.7	260	16.5	361	3.6	259	5.4
Total	6,162	10.8	5,497	9.5	7,093	5.88	6,406	5.1

TABLE II.—*Results in 50 flocks tested three times (does not include the 27 flocks shown in table I)*

	First Year		Second Year		Third Year	
	Birds Tested	% Positive	Birds Tested	% Positive	Birds Tested	% Positive
20 flocks decrease	3,079	18.90	4,527	11.11	3,430	3.4
26 flocks irregular	3,614	8.52	5,767	12.02	5,190	6.5
4 flocks increase	474	3.59	827	7.86	802	14.2
Total	7,167	12.65	11,121	11.33	9,422	6.0

TABLE III.—*Results in 231 flocks tested twice (does not include flocks in tables I and II.)*

	First Year		Second Year	
	Birds Tested	% Positive	Birds Tested	% Positive
173 flocks decrease	31,431	15.60	37,054	5.9
58 flocks increase	6,648	8.30	7,816	13.4
Total	38,079	14.36	44,870	7.3

Further study of the data shows that there are 51 flocks which have been tested one or more times with less than 1 per cent positive to the last test. Of course, 28 flocks were 100 per cent negative to the last test.

All positive birds are removed from the flocks by the inspectors and sold for slaughter as soon as the reports are received from the laboratory. After the hatching season was over last spring, a circular letter was sent to all the flock-owners who had had their flocks tested. Replies were received from a high percentage and these indicate that in the judgment of the flock-owners the general health and egg-production of their flocks had been improved, the livability of the chicks increased and the hatchability of the eggs bettered. There is ample evidence to show that the plan of bacillary white diarrhea control as is being carried on in Virginia is fairly effective in making it possible for those who, for a slight additional cost, desire to sell baby chicks that are reasonably free from disease. There is need, however, to go one step further, and that is to select flocks whose owners are intelligent and who are willing to cooperate and test more often than once a year with the idea of making those flocks absolutely free. It is believed that if a flock is tested two or three times at thirty-day intervals and proper sanitary precautions taken to prevent

reinfestation, that a free flock will result. These then would form a nucleus to which other free flocks could be added, which in time would be great enough to supply a large number of chicks which are 100 per cent free from bacillary white diarrhea. This, of course, would involve a large amount of work and would take time, but in the light of our present scientific knowledge, it seems the only way of controlling the disease.

PRESIDENT CARY: The next paper is "Some Experiments on the Control of Bacillary White Diarrhea," by Dr. L. D. Bushnell, Department of Bacteriology, Kansas State Agricultural College, Manhattan, Kans.

(The extemporaneous address of Dr. Bushnell is embraced in the following paper submitted for publication. Editor.)

SOME EXPERIMENTS ON THE CONTROL OF BACILLARY WHITE DIARRHEA*

By L. D. BUSHNELL *and* C. A. BRANDLY, *Manhattan, Kansas*

INTRODUCTION

Bacillary white diarrhea is today the most serious chick disease confronting the poultryman. Any methods which will reduce its activity will be of value to the industry. We have been studying the disease in Kansas for several years and have arrived at certain conclusions which may be of interest to this group. As in the control of any infectious disease, an attempt is made to attack it at its weakest point. In the case of the disease under consideration the point of easiest attack is the carrier. You are all familiar with the life history of the organism causing the disease and the general methods recommended for its control. In this paper we wish to present some of the results of our investigations.

FACTORS WHICH ARE KNOWN TO AID IN THE CONTROL OF THE DISEASE

There are certain measures which have been proved, during the past years, to be of value in the control of bacillary white diarrhea. These are listed about in the order of their relative importance.

1. The agglutination test.
2. Sanitation.
3. Improved methods of incubation.
4. Trap-nesting and frequent culling of flock.
5. Selection and breeding for disease resistance.

All methods which tend to prevent sick chicks from dying of this disease have been omitted. From the producer's standpoint

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*Contribution No. 112. Department of Bacteriology, Kansas Agricultural Experiment Station.

it may be of value to cure sick birds, but from the standpoint of disease control it is worse than useless, since it perpetuates a certain number of carriers in the flock. The pullorin test might be included in the above list although its value as a control measure has not been demonstrated. High humidity during hatching is also included because of its marked depressing influence on the circulation of chick down and dust in the incubators. By constant trap-nest records, and the culling of the flock by a good judge of birds, many of the diseased individuals may be eliminated. These birds are often non-producers, or low producers, and can be detected by the keeping of records. The plan of selection and breeding for disease resistance should be of great value but will not be practical from the standpoint of the average flock-owner. A combination of all the above methods will be of much value, while sanitation is absolutely necessary in combination with any of the others.

This disease is uncontrolled at present and is becoming more and more prevalent from year to year. We may discuss two phases of the dissemination of the disease—first, from the adult carrier to the offspring through the egg; and second, from one diseased chick to another through its immediate environment. Throughout the annals of disease control this disease stands unique in the last respect.

The fact that the disease passes from the adult to the chick through the egg has been recognized since its first discovery by Rettger in 1899. The fact that the organisms of the disease are spread through the air of the incubator has been recognized only since the work of Hinshaw et al., in 1926.* It would be difficult to find a more effective method of insuring a uniform distribution of a disease-producing organism than now surrounds the incubator production of chicks. This is the only disease in existence at the present time which is spread wholesale by machinery.

The disease is more highly infectious than is recognized by many poultrymen. Since it affects productivity, hatchability and growability, as well as livability, the extent of the loss it causes is difficult to determine, hence in many cases it is unrecognized. Most of these losses are entirely unnecessary because they may be eliminated by observing a few simple control measures.

*Vide "Studies in Transmission of Bacillary White Diarrhea in Incubators," by Hinshaw, Upp and Moore, published in the JOURNAL, February, 1926.

The spread of the disease in the incubator is due to the fact that when a chick hatches from an infected egg it is saturated with a culture of the organisms. As the chick dries, these organisms pass into the air of the machine and are later inhaled by chicks in other parts of the incubator. From results of various experiments we have estimated that in a laying flock of 10 per cent reactors each chick which hatches from an infected egg may cause the loss of 20 to 70 other chicks. The figures are based on the fact that about 2 per cent of the eggs laid by reactor birds hatch into infected chicks and that the average loss from this disease when infection is present is approximately 20 per cent of the total hatch. Thus it is quite evident that the treatment which chicks receive from the time they are hatched until they are a week of age will greatly influence the amount of infection which develops later.

The amount of infection due to exposure in the incubator is not known, but from evidence which we have a large percentage of it is due to incubation rather than to brooder exposure. This leads to the conclusion that this means of dissemination should be controlled as much as possible. It may be controlled to some extent by high relative humidity during hatching and by disinfection of the incubator between hatches, but the best method of control is to use eggs from disease-free birds. We believe that the hatchery is the greatest factor in bacillary white diarrhea dissemination in the country today, and we also believe that the hatcheries should be under more strict sanitary supervision than they are at present.

The belief that a large part of the deaths of brooder chicks is due to aspergillus infection has done much to delay the control of bacillary white diarrhea. It has been found that bacillary white diarrhea may be spread through the air of the incubator. It has been found also that *S. pullorum* will produce lung lesions in infected chicks. The presence of a disease of the lungs has led to the belief that chicks which die in the brooders succumb to an aspergillosis of the lungs. However, from our experience in Kansas very few brooder chick deaths are caused by aspergillosis and about 90 per cent of all losses in brooder chicks due to infections are due to *S. pullorum* infection. In support of this statement, we have never seen a case of aspergillosis in our laboratory. From an examination of 535 chicks which showed lung lesions, 426 (79.6%) showed caseous lesions and 109 (20.4%) showed a generalized pneumonic congestion. From 91 per cent of these

chicks at autopsy we were able to isolate *S. pullorum*. From none of these cases could we demonstrate aspergillus. In 400 other chicks from which *S. pullorum* was isolated no lung lesions were noted.

We are firmly convinced that *S. pullorum* is either the primary cause of brooder pneumonia, or very closely associated with it, and the eradication of bacillary white diarrhea will lead to the disappearance of the latter disease to a very large extent. Every effort should be made to emphasize to poultrymen the fact that brooder pneumonia is not a form of aspergillosis except perhaps in very rare cases.

The Agglutination Test as a Means of Control

There has been much criticism of the agglutination test in the past and there is some at present. We admit that it is not 100 per cent efficient, and the more inexperienced the person using it, the less effective it becomes. We do believe, however, that it can be used to control this disease. Some birds recover from the disease, others become diseased in adult life, while some harbor this infection in a portion of the body which does not make them actually dangerous to the offspring. Some are actually dangerous while others are potentially dangerous, or harmless, and yet unfortunately there is no difference in their reaction to the agglutination test.

A study was made of the variation in the testing of 59 birds of various ages which were kept over a period of eight months and tested five different times. The results of some of these examinations are shown in table I. In this table we have shown the variation in the agglutination titer as influenced by the time factor. We have made many tests in the past few years and do not agree with certain writers on the subject that the test is not a satisfactory means of detecting carriers.

We also wished to find which dilution used in the agglutination test was most significant in indicating actual infection. From work previously published from this station, it was shown that the dilution of 1 to 20 will detect more reactors than higher dilutions. We felt this dilution to be significant as indicating the carrier state because of finding diseased birds which did not show a reaction above a 1-to-20 dilution of the serum. In several flocks in which no reactors were found, and in which no losses had occurred from the disease, none of the birds showed reactions in the 1-to-20 dilution. We believe that there is no typical

agglutination in this dilution with serum of normal birds. Therefore, in the 1-to-20 dilution it signifies either past or present infection and the bird should be removed from the flock. We believe that the 1-to-25 dilution should be the accepted standard solution.

TABLE I.—*Variation in serum titer of 59 birds over a period of 8 months (serum titered 5 times)*

Birds	Original Titer	Titer After 2 Months			8 Months	
		Change	No.	%	No.	%
14	1–40	Increase	3	21.4	3	21.4
		Decrease	9	64.3	4	28.5
		No change	2	14.3	4	28.5
		To zero	0	0.0	3	21.4
14	1–80	Increase	2	14.3	3	21.4
		Decrease	8	57.2	5	35.7
		No change	4	28.5	5	35.7
		To zero	0	0.0	1	7.2
19	1–160	Increase	5	26.3	4	21.0
		Decrease	8	42.1	11	57.9
		No change	6	31.6	4	21.0
		To zero	0	0.0	0	0.0
9	1–320	Increase	1	11.1	1	11.1
		Decrease	4	44.4	7	77.7
		No change	4	44.4	1	11.1
		To zero	0	0.0	0	0.0
3	1–640	Increase	1	33.3	0	0.0
		Decrease	1	33.3	3	100.0
		No change	1	33.3	0	0.0
		To zero	0	0.0	0	0.0

The birds in this flock were fed a balanced ration and given excellent care. Of these, 4 (6.8%) have developed a competely negative reaction. On slaughter and postmortem examination none of the four birds showed lesions of bacillary white diarrhea and no cultures of *S. pullorum* were isolated. One bird showed congested ova from which *P. avicida* was isolated.

Of the 59 birds autopsied, 40 (68.1%) showed visible lesions of bacillary white diarrhea. From 25 of these *S. pullorum* was isolated in pure culture, from five *S. gallinarum* was isolated, from two a staphylococcus, from one a culture of *P. avicida*, from one a colon type, and from six no culture was obtained. Four birds, showing severe pericarditis but no ovarian lesions, gave cultures of *E. coli*. Four birds which showed necrotic areas in the liver and normal ova gave cultures of colon organisms.

In the remaining twelve birds we were unable to find lesions which would indicate the presence of bacillary white diarrhea, nor could we isolate *S. pullorum* from the liver or ovaries. It is impossible to state whether the birds were immune, or carriers of the organism, in some obscure part of the body.

According to these results there was a tendency for the titer to decrease rather than to increase. This tendency was more marked in those birds showing an original high-titer serum. It is seen that there was considerable variation in the titer from month to month. This is more marked in the high-titer birds and is another reason for using low dilutions of serum to indicate actual carriers. In testing such a flock as we describe, and with a 1-to-20 dilution, there would have been a difference of 6.8 per cent between the first and the last test. We may say from this that the reaction remained positive in this dilution in 93.2 per cent of the birds of this particular flock. With most series of tests it should be possible to obtain results which approximate this figure. With higher dilutions the test will be less uniform because of the greater fluctuation in this higher titer. Also borderline tests will vary considerably from time to time. If these doubtful tests are considered as negative and only clear-cut agglutinations considered as positive the tests will continue to be more uniform.

The Pullorin Test as a Means of Control

A study was made of several types of pullorin in an attempt to find a field test for the disease. Such a test would considerably stimulate interest in the control of the disease from the standpoint of the practicing veterinarian and poultryman.

The tests were made by introducing about 0.05 to .01 cc of the material into the skin of the wattle. Enough material was injected to cause a white spot 4 to 5 mm. in diameter to appear on the skin, or to result in a nodule the size of a grain of wheat. A positive reaction is an edematous swelling at least 5 mm. in diameter which persists for 24 hours. Discolored areas and slight thickening of the skin at the point of injection were considered negative. We experienced considerable difficulty in injecting a uniform amount of pullorin into different birds. With some birds the wattle is very small and the skin very thin, while in others the wattle is large and skin fairly thick and firm. The results reported in this paper have been obtained under conditions similar to those found in the field of general practice. As a basis

of comparison the agglutination test has been considered as a perfect indicator of a carrier condition. This is recognized as not being the case but for lack of better basis for comparison it has been used in this manner.

In order to analyze the relation between the pullorin reaction and the titer of the serum the examination shown in table II was made.

TABLE II.—*Comparison of agglutination titer of the serum to the pullorin reaction*

Agglutination Titer	Pullorin Reaction		Total	Per Cent Positive
	Positive	Negative		
0	1	3	4*	25.0
1–20	1	3	4	25.0
1–40	8	3	11	72.7
1–80	10	3	13	76.9
1–160	12	1	13	92.3
1–320	8	1	9	88.8
1–640	2	0	2	100.0
	42	14	56	75.0

*These four birds were negative to the agglutination test.

From these few figures it is quite evident that there is a much higher correlation between the pullorin and agglutination reactions when the serum titer of the birds is high.

A study was made between the autopsy findings and *S. pullorum* cultures and the pullorin reaction. Two flocks of birds were used: flock 1, of Rhode Island Reds, described in table II, and flock 2, consisting of a miscellaneous group of birds. All these birds reacted to the agglutination test in dilutions of 1 to 20 or higher and were considered to be actual reactors by repeated tests. The pullorin test was made two days before autopsy. Flock 1 was tested with freshly prepared alkali-digest pullorin,

TABLE III.—*The relation between the pullorin reaction and autopsy findings*

Flock	Birds Examined	Positive to Pullorin		Showing Lesions		Positive to Pullorin and Showing Lesions (%)	S. Pullorum Isolated		Positive to Pullorin and S. Pullorum Culture (%)
		No.	%	No.	%		No.	%	
1	51	36	70.6	40	78.4	90.0	25	49.0	69.4
2	62	45	72.6	53	85.5	84.9	37	59.7	82.2
	113	81	71.6	93	82.3	87.1	62	54.9	76.5

and flock 2 was tested mostly with ecto-pullorin. (These are described later in this article.)

The results of these findings are shown in table III.

The interesting fact is brought out by this table that about three-fourths of the birds which react show lesions of the disease, while from about one-half of the reactors it is possible to isolate *S. pullorum* in pure culture. It shows also that the pullorin and agglutination tests are correlated to about the same extent as the pullorin reaction and autopsy findings.

Positive to agglutination test and positive to pullorin........71.6%
Positive for lesions and positive to pullorin........................87.1%
Positive for *S. pullorum* culture and positive to pullorin....76.5%

While these percentages are not very close, yet they are probably within the limits of error for such findings. It is probably safe to conclude from such data that the agglutination test is a fairly accurate means of locating actual carriers of the disease. The pullorin test, as used in these experiments, is not accurate enough for the practical elimination of the disease.

In table IV we have listed the results of a study of several types of pullorin. The term "Ppt" refers to a dried precipitated pullorin which was suspended in sterile salt solution immediately before use; "Cell" refers to a cellular suspension in sterile salt solution (the organisms were killed either by heat or chemicals); "Ecto" refers to a dissociation product which is obtained in the washings from the cell. (This product was freed from organisms by filtration through porcelain or the supernatant fluid was heated or treated with chemicals);"Digest" is a pullorin obtained by treating a heavy washed-cell sediment with N/10 NaOH for a few minutes and diluting ten times with sterile salt solution and sterilized by heat or chemicals and used fresh. (It must be used the same day it is prepared to obtain good results.)

As a basis of comparison we have used the agglutination test as being 100 per cent efficient and on this basis determining the association coefficient with the various pullorins. We have included results on several flocks for each type of pullorin in order to give an idea of the variability in the results obtained.

The pullorins varied in association coefficient from 0.23 to 0.89, with an average of 0.67. Such variation is probably to be expected at the present time and will continue until a more uniform method of preparing the product has been devised. From our experiments the "Digest" and "Ecto" antigens, which

TABLE IV.—*The relation between the agglutination test and various types of pullorin*

PULLORIN	BIRDS	REACTORS AGG. TEST (%)	ASSOC. COEFF.	AVERAGE ASSOC. COEFF.
Ppt. A	142	61.2	0.71	
Ppt. B	143	27.9	0.23	
Ppt. C	174	55.2	0.54	
Total	459			0.49
Cell A	121	85.9	0.38	
Cell B	133	0.0	One reactor	to pullorin
Cell C	92	43.5	0.74	
Cell D	116	24.0	0.89	
Total	462			0.67
Ecto. A	51	43.1	0.76	
Ecto. B	92	43.5	0.94	
Ecto. C	116	24.1	0.89	
Ecto. D	581	21.1	0.46	
Total	840			0.76
Digest. A	161	41.4	0.75	
Digest. B	66	60.6	0.62	
Digest. C	143	20.0	0.64	
Digest. D	34	85.3	0.84	
Digest. E	95	0.0	No reactors	to pullorin
Digest. F	113	23.0	0.71	
Digest. G	109	9.1	0.85	
Digest. H	225	23.2	0.89	
Total	946			0.75

are very easy to prepare, seem to be superior to the other types although they must be used fresh to give the best results. We have tried numerous methods of concentrating the active principle of the antigens but without success. Some have been condensed in the open air, others at reduced pressure; some killed by phenol, chloroform and by heat; some digested with alkalies of various concentrations; but the results are not constant enough to warrant their general use at present, or to allow us to say that one product is much superior to another.

SUMMARY

We may summarize the above discussion by saying that bacillary white diarrhea is a serious disease of baby chicks which is disseminated to a large extent through the air of the incubator. The brooder pneumonia so common in young chicks is caused, in most instances, by *S. pullorum* infection of the lungs. The

disease may be controlled by use of the agglutination test and proper sanitary conditions surrounding the flock. The pullorin test, in its present state of development, cannot be recommended for this purpose. The pullorin which has given the closest correlation to the agglutination test is an "Ecto" pullorin prepared from young cultures of the organism. The reactions to this product are not sufficient to make the readings easy and in come cases it is difficult to tell whether a bird should be considered as showing a positive or negative reaction. With the "Alkali-digest" pullorin the reactions are more pronounced although the correlation to the agglutination test is no higher than with the "Ecto" product. This latter product seems to retain its reactive properties but a few hours, even in the ice-box. For this reason it cannot be recommended for general use until some method of stabilizing it has been determined. The use of methods to cure sick chicks should not be recommended. The breeding of birds and selection for disease resistance will not be practical for the general fiock-owner, but it will be of value to develop certain flocks from which disease-resistant stock can be purchased.

PRESIDENT CARY: The next paper is "The Need of Accepted Scientific Standards and Rigid Adherence to Them in Pullorum Disease Control," by Dr. Leo F. Rettger, Professor of Bacteriology, Yale University.

. . . Dr Rettger read his paper. . . .

THE NEED OF ACCEPTED SCIENTIFIC STANDARDS AND RIGID ADHERENCE TO THEM, IN PULLORUM DISEASE CONTROL

By LEO F. RETTGER

Professor of Bacteriology, Yale University,
and
Bacteriologist, Storrs Agricultural Experiment Station.

Perhaps no other subject in the poultry world is today eliciting as much interest as bacillary white diarrhea of chicks. The topic is far from being a new one, the first investigations in this field dating back as far as 1899. The widespread occurrence of this disease throughout the world is assuming such importance that many government and state authorities, not saying anything of numerous institutional laboratories, have become more and more interested in the epizoology of the disease and in possible means of materially reducing the losses from it.

My close contact with the problem from the beginning to the present moment has convinced me that the progress of this scourge, from what appeared twenty-five years ago as more or less isolated disturbances and of comparatively little economic importance, has to date reached such proportion that the poultry industry must either resign itself to an inevitable fate, or take drastic measures to prevent the losses accruing from it.

Private communications which I have had from time to time from various poultry-owners and representatives of poultry associations have been most illuminating in that the writers seemed assured, in some instances at least, that bacillary white diarrhea is a myth. In fact, so aggressive has this attitude been on the part of some producers that it would seem from their own claims that whole counties or even states are absolutely free from this scourge. The past hatching and breeding season in particular has brought many of the disclaimers, and large producers too, face to face with the disease in its most exaggerated form.

Bacillary white diarrhea is, with few exceptions, a disease which is known to affect visibly only young chicks. The chick phase, of course, is only a part of its cycle of development and spread. As you must all know, this disease is transmitted through breeding hens, in the ovaries of which *Bacterium pullorum* has become localized and may be present in very large numbers. Eggs from such breeders are a potential source of danger to the young stock hatched from them, in that in certain proportions, sometimes large and sometimes small, the eggs are infected with the organism of bacillary white diarrhea, and hence chicks which are hatched from them naturally carry the specific organism and transmit it to other chicks with which they are permitted to run. Unfortunately, not all infected chicks succumb to the disease in the shell, and many of those which survive become permanent carriers and later as breeders complete the cycle of infection.

The disease may be spread also from bird to bird in growing or mature stock, through natural channels, that is contaminated food and water, and thus may perpetuate itself in flocks to which no young stock has been added. Birds after their fifth or sixth week of age seldom react visibly to the organism carried in their system, but frequently become permanent carriers themselves. Not only is this true in so far as localization in the ovary is concerned, but there may be acquired localized infection in the pericardial sac or in different parts of the body in the form of isolated cysts.

In more recent years the question of possible danger to man from the ingestion of uncooked or undercooked eggs has been one of increasing interest. Repeated experiences have shown that young rabbits up to half-grown, and small kittens as well, are very susceptible to *Bacterium pullorum* when fed by mouth. There is as yet no evidence that children have been infected with this organism, but a knowledge of the various causes which are responsible for so many intestinal disturbances in young infants is as yet so meager that it would be folly to say at this time that children do or do not suffer from this type of infection. At any event, this whole subject has some human interest aside from the economic losses which it causes in poultry stock.

The term "bacillary white diarrhea" is not sufficiently inclusive for the reasons just stated. Recently a suggestion has come from the Pennsylvania State Department of Agriculture that the term "pullorum disease" be used as applying to all infection with *Bacterium pullorum*, whether in young chicks or adult stock and birds of the air, or possibly human beings, and that it be used synonymously with, or as a substitute for, "bacillary white diarrhea." This suggestion appears to me to be most appropriate and through the remainder of this paper I shall refer to the disease as "pullorum disease."

For several years a definite solution of the pullorum disease problem has been sought earnestly by various investigators. Connecticut was the first to apply scientific methods of control, having inaugurated its initial carrier study work over fifteen years ago, when efforts were made to identify infected breeding hens by the examination of eggs for the presence of *Bacterium pullorum*. This method was soon found to be costly, cumbersome and impractical, and gave way to the agglutination method which has long proven itself practical in the diagnosis of various animal and human diseases, particularly typhoid fever.

Three distinct methods of determining *Bacterium pullorum* infection in breeding stock are being advocated today. One is the regular agglutination test as practiced now throughout the country. The second is the so-called rapid agglutination method, and the third the intracutaneous pullorin test.

While it is not my intention to belittle any of these methods, I feel satisfied that the ordinary agglutination test, when properly conducted, will be found in the long run to be the most dependable and practical, and perhaps most free from abuse by routine technicians.

Much is being said about the need of improved methods of diagnosis, and in some sections no energy has been spared in attempts further to standardize. This is as it should be, but in our search for more nearly perfect procedures we have lost sight of the human element, and of the abuse to which existing methods have been and are quite generally being put.

Not only is the carrying out of the laboratory technic too often placed in the hands of untrained and irresponsible persons, but too little attention has been directed to the work that should follow immediately upon the heels of the test itself. For example, inadequate instructions are given to owners and managers of flocks regarding the proper disposal of reactors, and too little attention has been given to following up instructions and preventing owners from ignoring them by failing to remove all carrier birds and by not erecting adequate barriers against the introduction of infected stock from the outside.

The personal element is as a rule the most difficult factor to control, not only in laboratory technicians and in supervisors, but also in so far as the field men are concerned who do the collecting of samples and follow up instructions of the office through which the work is done. No matter how nearly perfect any standardized laboratory method may be, no two groups of technical diagnosticians, unless similarly schooled, will carry out instructions in the same manner and there can be no doubt that in some instances the results by two or more laboratories on the same blood samples may differ very widely. This failure to attain uniformity is more often one of the technician than of the method itself.

I am of the confirmed opinion that our greatest need today in devising ways and means for obtaining the most out of an accepted diagnostic method is to establish a system of training and supervision of blood-testing personnel whereby the persons who qualify for the work obtain a thorough grounding in the principles governing the test and intensive drill in conducting it according to those principles. The work of blood-testing should be kept out of the hands of all who are not so qualified, by rigid enforcement of appropriate rules and by public sentiment generally.

Until such a stage in the development of this branch of animal disease prevention has been reached, owners of flocks will be more or less at the mercy of untrained, irresponsible and even unscrupulous persons who pose as qualified technicians and directors. Furthermore, until such a stage is attained it seems to me

that owners who are face to face with the problem of pullorum disease control and eradication should hesitate a long time before they place this important solution of the problem in the hands of any given individual or group of individuals. As I have said in previous publications, full responsibility for the diagnosis of pullorum disease in breeding stock and for the carrying out of instructions based on the laboratory tests, should be placed in the hands of competent and acceptable institutions, rather than private individuals.

After years of experimentation at the Storrs Experiment Station, Connecticut has evolved a system of pullorum disease diagnosis and eradication which has received the confidence and moral support of the poultry industry of the State, and which, we have every reason to believe, will in the course of a few years bear full fruit. In order that others may perhaps profit by our experiences, I shall briefly present here some of the main features of the Connecticut system, which owners of poultry enter into voluntarily.

In accordance with Chapter 199, Public Acts of 1925, the Commissioner on Domestic Animals was given authority to promulgate rules and regulations and render assistance in the control and eradication of bacillary white diarrhea. Under this sytsem qualified owners place all of their breeding poultry under the supervision of the Commissioner's department, and agree by writing to comply with its rules and regulations, which are briefly as follows:

All poultry kept for breeding must be blood-tested. No pullets or cockerels of the same age shall be tested until two months after the pullets have attained 20 per cent production.

When any birds are found to react to the agglutination test all positive and doubtful birds shall be isolated and quarantined, and disposed of by slaughter within ten days from the date of the order, and an affidavit by the owner that such disposition has been made shall be mailed immediately to the Commissioner. When only doubtful reactors have been found, they shall be isolated and held in quarantine until another test is made.

(Then follow directions for cleaning of houses, yards and pails, and for general disinfection.)

When a flock has been officially tested, the reactors removed and the rules complied with, the Commissioner shall issue to the owner a certificate and place his name on a list entitled, "Officially Tested and Reactors Removed." When a flock has been sub-

Much is being said about the need of improved methods of diagnosis, and in some sections no energy has been spared in attempts further to standardize. This is as it should be, but in our search for more nearly perfect procedures we have lost sight of the human element, and of the abuse to which existing methods have been and are quite generally being put.

Not only is the carrying out of the laboratory technic too often placed in the hands of untrained and irresponsible persons, but too little attention has been directed to the work that should follow immediately upon the heels of the test itself. For example, inadequate instructions are given to owners and managers of flocks regarding the proper disposal of reactors, and too little attention has been given to following up instructions and preventing owners from ignoring them by failing to remove all carrier birds and by not erecting adequate barriers against the introduction of infected stock from the outside.

The personal element is as a rule the most difficult factor to control, not only in laboratory technicians and in supervisors, but also in so far as the field men are concerned who do the collecting of samples and follow up instructions of the office through which the work is done. No matter how nearly perfect any standardized laboratory method may be, no two groups of technical diagnosticians, unless similarly schooled, will carry out instructions in the same manner and there can be no doubt that in some instances the results by two or more laboratories on the same blood samples may differ very widely. This failure to attain uniformity is more often one of the technician than of the method itself.

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(Then follow directions for cleaning of houses, yards and pails, and for general disinfection.)

When a flock has been officially tested, the reactors removed and the rules complied with, the Commissioner shall issue to the owner a certificate and place his name on a list entitled, "Officially Tested and Reactors Removed." When a flock has been sub-

jected to an official test and found to be without reactors, a certificate shall be issued to the owner and his name shall be placed on a list entitled, "Tested and Found to be Without Reactors." When a flock of mature birds has been subjected to two consecutive annual tests (or four semi-annual tests in the case of pullet-breeding), and found to be without reactors in each of such tests, the Commissioner shall issue to the owner thereof a certificate and place his name on a list entitled, "Accredited Free from Bacillary White Diarrhea."

When a flock has been accredited as free from bacillary white diarrhea, 20 per cent of the flock on hand November 1 next shall be tested at the expense of the owner each year.

When one reactor, or not more than 2 per cent of the entire flock, is found to be positive on any retest of an accredited flock, a retest of the entire flock must be made in from six to eight weeks. If this retest reveals no reactors, said flock can be reaccredited. When more than 2 per cent of the entire flock is found positive on any retest of an accredited flock, the flock will lose its accreditation and will be listed as a flock "officially tested and reactors removed."

No poultry shall be added to an accredited flock or a flock in the process of accreditation unless from a flock under supervision of the same status, except that poultry from an untested flock may be added to the flock after successfully passing one test subject to a retest in six weeks.

Violation of the letter or spirit of these rules and regulations shall be considered sufficient cause for the immediate cancellation of agreement and withdrawal of cooperation by the Commissioner.

This system, as adopted and enforced by the Department of the Commissioner on Domestic Animals, has been in full operation about three years. Full responsibility for the blood-testing phase of the work has been assumed by the present writer, in whose laboratories the serological tests are conducted by trained technicians, and results of the tests recorded and transmitted to the Commissioner's office.

Just a few words about the laboratory phase of the control problem, upon which successful execution of an adopted program or scheme so largely depends. In the first place, no end of abuse has been practiced in the collection of the blood samples. It is absolutely imperative that the samples reach the laboratory in a good state of preservation. The blood must not be permitted

to come in contact with even the smallest amount of water; it must be preserved against freezing, and yet be kept sufficiently cool to prevent the least spoilage. Samples should be cooled immediately and delivered to the laboratory as quickly as possible. When sent a long distance, and particularly during warm weather, they must be packed in sufficient ice to preserve them. The generally adopted packing case or pail (covered) is one in which there is an inner compartment with tight-fitting cover in which the tubes are packed upright, preferably corked with clean corks. There should be ample space between this container and the wall of the pail to hold an adequate ice supply, when this is needed.

The blood samples must be subjected to the test while they are still in a well-preserved state, and care must be exercised in removing the serum with as little hemoglobin as possible. The serum is then made up to the required dilution with *Bacterium pullorum* stock antigen and physiological salt solution.

We have been using two dilutions of serum, 1:50 and 1:100, for every blood sample. With complete eradication of pullorum disease in flocks as our chief, and in fact only real goal, we believe that official dilutions lower than 1:50 (certainly as low as 1:25) will lead us into difficulties in that there will be frequent non-specific reactions, and make it extremely difficult to establish and maintain negative (accredited) flocks. The use of 1:25 as an unofficial so-called finding dilution cannot meet with serious objection, except as an added expense.

Again, because the chief aim of our system is to establish accredited flocks throughout the State, as sources of sound breeding stock, it appears to us necessary to record all partial, incomplete or atypical reactions as doubtful. Hence reports of the tests are given as positive, negative or doubtful.

Can such a system be used on commercial flocks of any size? My answer would be "Yes, if properly conducted." True, there are few relatively large flocks in Connecticut, not one of those that have participated in our eradication scheme being composed of more than 5000 or 6000 breeding birds. This may be an important factor in the success thus far obtained in this state.

It appears to me that a positive answer to the above question can be found in the adoption of what may be conveniently called the "unit system" of poultry raising. On any large commercial plant it should be possible, and eventually prove to be highly practicable, to build up individual units by systematic testing

and the use of eggs and young chicks only which come from originally negative flocks, or from flocks which had very little infection and have become pullorum-free after removal of the few scattered reactors. With strict adherence to rules governing such a program, it should be feasible eventually to build up a multiple of units and finally a general system of eradication which could and would definitely preclude the use of breeding stock which is not thoroughly sound in so far as pullorum disease is concerned.

No known method of diagnosis is absolute and thoroughly satisfactory, and it would be folly to hold that the ordinary agglutination method or any other diagnostic procedure is or ever will be entirely beyond criticism. In a previous paper, read in this city a year ago, I stated: "That the agglutination method for identifying *Bacterium pullorum* carrier birds has, in a large measure, failed to accomplish what it was originally intended to do, namely *locating with precision individual* infected hens in given flocks, cannot be denied by any one who has been at all engaged in this field of study." Let me add at this time that the same thing may be said regarding any and all known diagnostic methods.

This statement has recently been quoted boldly on the front page of one of our more prominent poultry journals. That the authors did not grasp the full meaning of the paper from which it was taken, or intentionally attempted to misrepresent my attitude toward the test is indicated by the fact that this particular paragraph was singled out, apart from others in which confidence in the real value of the test was clearly brought out.

In conclusion, let me repeat that eradication of pullorum disease from poultry flocks is a practical and feasible thing, and that the adoption sooner or later of a definite standardized and scientifically and reliably operated system of control based upon accepted tests will be found quite generally to be the real solution of the pullorum disease problem. Such a system should not be made compulsory, however, at least for some time to come.

APPENDIX

Summary of testing for bacillary white diarrhea to November 26, 1928.

State of Connecticut

J. M. Whittlesey, ***Commissioner on Domestic Animals***
Geo. E. Corwin, ***Deputy Commissioner***
State Capitol, Hartford, Connecticut

Accredited flocks—test complete this season	53
Accredited flocks—test not yet made this season	5
Birds in accredited flocks	48,198

Free flocks—mature birds tested but pullet test has not been made...	32
Free flocks—test not yet started this season	9
Birds in free flocks which have been tested	12,584
Birds in free flocks—test not yet started	2,281
Officially tested flocks—mature birds tested but pullet test has not been made	50
Officially tested flocks—test not yet started	23
Birds in officially tested flocks which have been tested	36,010
Birds in officially tested flocks—test not yet started	12,508
Reactors this season since July 1, 1928 (1.8%)	1,010

But two flocks have lost their accreditation this season.

PRESIDENT CARY: Our next paper is "A Survey of Poultry Pathology, Past, Present and Future," by Dr. Hubert Bunyea, Pathological Division, Bureau of Animal Industry, Washington, D. C.

. . . Dr. Bunyea read his paper. . . .

A SURVEY OF POULTRY PATHOLOGY, PAST—PRESENT—FUTURE

By HUBERT BUNYEA, *Washington, D. C.*

Associate Veterinarian, Pathological Division, Bureau of Animal Industry, U. S. Dept. of Agriculture

INTRODUCTORY

With the recent unprecedented advance in economic importance of the poultry industry, the science of poultry pathology has been undergoing a correspondingly rapid evolution. It is a young science, so young that some of its foremost pioneers are still living. So engaging is this field of scientific research, and so manifest its practical and economic importance, that it is being accorded a place of increasing prominence in the experimental activities of federal and state research workers, in the literature, in the curricula of the professional schools, and in the routine of the practitioners. So phenomenal has been the progress of avian pathology that the last half-century has witnessed the accumulation of a vast store of fundamental information on this subject.

It is the purpose of the present report to offer a summary of outstanding discoveries in the beginnings of avian pathology, following with a brief review of noteworthy scientific accomplishments of the present day in that domain, and including a statement relating to important poultry diseases which have but recently come prominently to the attention of pathologists, or concerning which, for some other weighty reason, further research seems urgent or eminently desirable.

Historical

It is necessary to cite only a few of the early landmarks to establish the fact that this bracnh of pathological science has arisen upon an impregnable foundation of sound, careful investigation and well-substantiated truth.

Among the earliest outstanding researches in this field of knowledge were those of Pasteur, in fowl cholera, in 1880, and of Koch, in avian tuberculosis, in 1882. An infectious enteritis of chickens was reported by Klein, of England, in 1889, and later recognized as identical with fowl typhoid, whose causative organism *Bact. sanguinarium*, was described by V. A. Moore, then of the Pathological Division, U. S. Bureau of Animal Industry. In that memorable year also a far-reaching investigation of blackhead of turkeys was reported by Theobald Smith, also then of the Bureau of Animal Industry. These were the days of D. E. Salmon, first chief of the Bureau, and himself an investigator and writer on avian pathology. Five years later, bacillary white diarrhea of chicks was recognized as a distinct entity. In the earliest researches on this condition the name of L. F. Rettger stands pre-eminent. The first report of his investigations on this subject was in a paper on "Septicemia Among Young Chicks," in the *New York Medical Journal*, in May, 1900. Rettger and subsequent investigators have since contributed many important findings concerning this disease. A recent bibliography on the subject, by W. A. Hooker, contains 345 references to the literature included in this period.

It is now proposed to review individually a few of the principal poultry disease problems existing in this country which demand fuller investigation.

Avian Tuberculosis

Although tuberculosis was observed in poultry long before his time, Koch was the first to establish definitely the etiological relationship of the acid-fast organism for the disease, in 1882. Researches reported by Rabinowitsch, in 1904, by Bang, in 1908, and more recently by Van Es, tended to establish the range of pathogenicity of the avian organism with respect to mammalian species. An outstanding phase of the work of Mohler and Washburn was the convincing evidence that young swine could be naturally infected with fowl tuberculosis by feeding upon the carcasses of infected fowls.

The finding of tubercle bacteria in two eggs from a tuberculous hen by these investigators is suggestive of the possibility of the transmission of the disease from hen to chick by means of the egg.

Fitch, Lubbehusen and Dikmans, in 1924, examined 876 eggs from 43 hens, some by culture and some by animal inoculation, for the presence of tubercle bacteria, but found the organism only in the composite of nine eggs which came from two hens known to lay, occasionally, infected eggs. These investigators were of the opinion that the transmission of avian tuberculosis through the egg is a possibility of small consequence. In a later investigation (1928) Fitch and Lubbehusen assembled a flock of 88 tuberculin-reacting hens, the eggs from which (2,000 in number) were incubated and 697 chicks were produced. Of these, 209 were tuberculin-tested and autopsied, with invariably negative findings. Apparently none of these chicks were reared to maturity.

In the spring of 1925 there came to the attention of the present writer a flock of 1,075 hens among which numerous autopises had disclosed the existence of many cases showing advanced tuberculous lesions. A tuberculin test of this flock made by W. S. Gochenour, of the Pathological Division, resulted in finding 21.5 per cent of reactors. Meanwhile a number of eggs were collected from the flock and inoculated with a view to studying the possible transmission of tuberculosis from hen to chick by means of the egg. From this hatch 276 chicks were obtained. From this beginning the study was pursued for three generations of birds from the above-mentioned tuberculous parent stock. In all, 361 fowls were reared, 77 of them to ages ranging from 7 to 12 months, and 19 lived from 13 to 23 months. In all, 125 fowls were tuberculin-tested, and gave negative reactions. Two hundred forty-seven fowls were autopsied at death or slaughter and showed no lesions of tuberculosis. The remaining birds were utilized in other unrelated experimental work, and all attained a certain degree of maturity, but none showed subsequent evidence of tuberculosis.

Although the original materials for this investigation were not so well controlled as might have been desired, the work is cited for what significance it may possess, and also as being suggestive of further research into the possible transmission of tuberculosis from tuberculous fowls to their offspring by means of the egg.

Bacillary White Diarrhea

The first scientific knowledge concerning this disease was given to the world by L. F. Rettger, who, in 1900, isolated the germ

which he named *Bacillus pullorum*. This organism, now known as *Salmonella pullorum*, was later found to have its habitat in the ovaries of infected hens, which became, through their infected eggs, the source of dissemination of the disease among chicks. Rettger collaborated at different times with Harvey, Stone, Kirkpatrick, Jones, Card and others, leading the way in further studies of the disease, including its etiology, epizoology and pathology. Other investigators independent of these also have contributed important findings with reference to the condition.

Jones, in 1913, developed the agglutination test for the detection of carrier hens, which is coming to be the basis of a nation-wide campaign against the disease. In 1917, Ward and Gallagher announced the discovery of an intradermic diagnostic test. In 1927, Runnells, Coon, Farley and Thorp reported the application of the rapid-method agglutination test to the diagnosis of bacillary white diarrhea infection.

There are doubtless still many questions we should like to have answered. These questions are coming in for their full share of attention by those of us who do not embrace the belief that the last word has been spoken upon the subject. Extensive investigations are now being conducted at the U. S. Animal Disease Experiment Station at Bethesda, Md., and some of the state agricultural experiment stations on incubator transmission of bacillary white diarrhea, the disinfection of incubators and brooders, diagnostic methods and other related problems. One need possessing a most practical economic urge is the development of better standardized and less costly methods of diagnosis of the disease in breeding flocks With the solution of this problem it is possible that we would be in a better position to get together on a nationally unified plan of control of the disease, looking hopefully toward its eventual eradication.

The literature cited in reference to this subject is listed in Hooker's "Bibliography of Bacillary White Diarrhea of the Fowl."

Diphtheria (Bird Pox)

Early investigators attributed avian diphtheria to a variety of causes, including protozoa and several types of bacteria. In 1897, Sanfelice reported an investigation the results of which led him to classify the pox lesions as a form of blastomycosis. In 1902, Marx and Sticker demonstrated the filtrability of the pox virus, but it was not until 1908 that experiments conducted by Carnwath showed that the viruses of pox and diphtheria were

identical, and that material from either type of lesion was capable of producing lesions of the other type. Following the new light thus gained as to the etiology of the disease, the attention of science was centered upon methods of prevention by immunization. Emulsions of the diseased tissues were employed by intravenous or subcutaneous injection, by Manteufel, Beach, Hadley and others, with encouraging results. More recent researches, however have been conducted by DeBliek and Van Heelsbergen, of Utrecht, Holland, and W. T. Johnson, of Corvallis, Oregon, indicating the possibility of establishing an active immunity to pox-diphtheria by means of cutaneous vaccination.

The relationship existing between roup and the pox-diphtheria infection is yet an open question. Successful attempts at immunization against roup have thus far been confined to the use of suspensions of killed organisms consisting of secondary bacterial invaders found present in outbreaks of the disease. The etiology of this condition, and its prevention and control are problems of great importance to the industry in the United States, and urgently call for the further scrutiny of the pathologist.

Fowl Cholera

Fowl cholera was studied, in 1782, by Chabert who considered it to be a form of anthrax. The disease has been frequently observed in Europe since 1925, and more recently in the United States. Perroncito, in 1878, gave the first description of the causative organism of fowl cholera as it appeared to him from microscopic examination of the blood of affected fowls. Two years later, Pasteur achieved the distinction of being the first to cultivate upon nutrient media this organism which later was to derive its family name from him. By way of further distinction, Pasteur used the attenuated bipolar germ of fowl cholera with which to blaze the trail for the development of vaccinotherapy. To use the words of Salmon, "This is the first case in which a virulent germ was successfully modified in a laboratory and made to act as a vaccine. It led to the preparation of vaccines for a number of diseases, more particularly anthrax, black quarter and rabies." Since Salmon's statement was penned, vaccinotherapy has advanced by rapid strides and now occupies a prominent place in the prevention and treatment of numerous infectious diseases of man and animals.

As regards the active immunization of fowls against cholera, however, Pasteur's vaccine appears to have been less successful

than those later developed by Szäsz, Manninger and others. Effective antisera for the passive immunization of fowls were developed by Kitt, and also by Schreiber. Weil's attempts to produce an immunity to fowl cholera with the aid of artificial aggressins, while not of much practical significance, at least offer a possibly fruitful clue to encourage further similar efforts on the part of other investigators. The possibilities of aggressin immunization for this disease in fowls appear even more promising in the light of Gochenour's recent favorable results accomplished with the corresponding bovine aggressin.

Fowl Typhoid

Fowl typhoid is described by early European writers as an infectious disease fatal to chickens, young turkeys, guinea fowl and pheasants. With Lucet's enzootic dysentery of turkeys and Klein's infectious enteritis of chickens it is said to be identical. The condition was first described in the United States by Moore, in 1896, under the caption, "Infectious Leukemia in Fowls—A Bacterial Disease Frequently Mistaken for Fowl Cholera."

As a result of recent observations on the occurrence of an organism bearing the cultural characteristics of *Salmonella sanguinarium* in young chickens dying of white diarrhea and partly due to the cultural and serological similarities of *S. sanguinarium* and *S. pullorum*, some recent investigators display a tendency to regard the two organisms and the diseases produced by them as closely related if not identical.

On the other hand the gross pathological changes noted in fowl typhoid in adults often simulate those of avian leukemia, which fact accounts for the name of "infectious leukemia," suggested by Moore for the former disease. One is led to wonder whether some of the cases diagnosed as leukemia are not in fact occult forms of fowl typhoid. The writer recalls a case of apparent leukemia which came under his observation, cultures from which failed to yield an organism, but tissue emulsions from which, when injected into a chicken experimentally, produced a fatal leukemic disease from which *S. sanguinarium* was recovered.

Vaccines are extensively employed in the protection of fowls against typhoid infection. The use of such products, however, has been found by Runnells and his associates to cause confusing results in the subsequent agglutination testing of these fowls for bacillary white diarrhea infection, due to the reciprocal non-speci-

ficity of the agglutinins produced by these infections for each other.

Infectious Bronchitis

About seven years ago there began to appear, in the large, central, poultry-feeding establishments of the middle-western part of the United States, a new disease of an infectious nature and an acute course, affecting the respiratory tract of chickens. Because this new disease had been said to exist prior to that time in Canada, it became commonly known as Canadian flu. To science, however, it is more generally known as infectious bronchitis, or influenza. The ravages of this disease presented so serious a problem in the commercial feeding or shipping of live poultry that the attention of pathologists in various sections of this continent was directed to an investigation of the condition.

Gwatkin described infectious bronchitis as a form of avian diphtheria or chicken pox, "a very acute form in which the trachea fills with a sticky, bloody exudate and clots of blood, and in which no yellowish, cheesy matter collects in the mouth and larynx." As a basis for his conclusion, that investigator cites the production of pox or diphtheria lesions from the inoculation of test birds with bacteria-free filtrates derived from the tracheal exudates of bronchitis birds.

According to the present writer's observations, infectious bronchitis is a distinct entity, differentiable from avian diphtheria, roup and chicken pox. This conclusion has been reached after repeated failures to produce any of the disease manifestations enumerated by the intratracheal or subcutaneous inoculation of the Berkefeld-filtered, tracheal exudates from bronchitis subjects, while at the same time the intratracheal inoculation of the fresh unfiltered exudates resulted with much regularity in the reproduction of infectious bronchitis, after an incubation period ranging from three to seven days.

Thus far the writer's conclusions are based upon findings derived from the investigation of the 1924-25 outbreak of infectious bronchitis, but which are fully confirmed by his investigations conducted in a more recent outbreak. Early efforts to clarify the obscure etiology of the disease, however, were unsuccessful beyond the point of satisfying himself that it was not due to a filtrable virus.

In the study of the disease there was encountered a percentage of cases complicated with the presence of fowl cholera infection,

but not in sufficient numbers seriously to suggest an etiological relationship between the Pasteurella and infectious bronchitis. This finding in avian diphtheria has been reported by Moore, Sigwart and others. Similar findings in infectious bronchitis and a similar interpretation of them are recorded by J. R. Beach, of California.

Some other cases under the writer's observation manifested symptoms and lesions of infectious bronchitis complicated with avian diphtheria, or pox, or both. Had these specimens been employed by him as representative subjects in an etiological study, it is speculatively possible that they might have yielded results similar to those of Gwatkin, erroneously suggesting the etiological oneness of infectious bronchitis with pox and diphtheria. Beach, in reporting the presence of chicken-pox virus in some of the bronchitis specimens studied by him, conservatively maintains that "the importance of this virus in the etiology of the disease, however, is not definitely determined."

Kaupp reports the recovery, from the tracheas of affected chickens, of a diplococcus which he regarded as the etiological factor in infectious bronchitis. His organism, which was definitely identified as *Diplococcus pneumoniae capsulatus*, proved pathogenic for white mice, but with it he was not able to reproduce bronchitis in fowls experimentally. Hinshaw reports the finding of an organism resembling *Pasteurella avicida* in the tracheas of affected fowls studied by him, but did not ascribe etiological significance to this organism.

Eriksen was unable to reproduce infectious bronchitis experimentally, and therefore inclines to the belief that the disease is of non-specific origin. Among the factors which he regards as predisposing to the disease are:

"Poor state of nutrition when leaving the farm.

"Exposure and delay in unsanitary quarters of small local buyers.

"Exposure to cold and filth in poultry cars.

"Rapid forcing of birds not properly developed.

"Improper ventilation and sanitation of feeding stations."

The present writer has been able to reproduce the disease experimentally by placing test birds in the same pen with naturally infected birds. The usual method he practiced, however, was that of transferring the tracheal exudate by means of a swab directly from the infected bird to the test bird. During a recent outbreak, a study was made of the bacterial flora of the

trachea of a number of natural cases. Several types of organism were isolated and tested as to their pathogenicity by tracheal inoculation of normal fowls. None, however, proved capable of reproducing the symptoms and lesions of infectious bronchitis except a diplococcus which was recovered from a number of cases.

A freshly isolated culture of this organism, washed off of a serum-agar slant, was introduced by means of a swab into the tracheas of several birds. In three days these birds were showing symptoms ranging from a mucous rale to a slight dyspnea. On the fourth day they died, and upon autopsy showed the typical exudative plug in the trachea. Later attempts to produce bronchitis by the tracheal inoclation of this organism taken from cultures of the fourth or fifth generation were unsuccessful.

Most of the writer's successful transmission work was accomplished upon birds in open-air pens in mid-winter. Similar uninoculated fowls in similar pens survived a like exposure to inclement weather conditions without showing any ill effects. In view of Kaupp's finding, and his own, the writer is inclined to regard the diplococcus of pneumonia as of possible significance in the causation of the disease under adverse sanitary or climatic conditions. However, the field is open to further research on the questions concerning this disease, among which might be suggested that of the possible value of bacterins made from avian pneumonia organisms in the prevention of infectious bronchitis during shipment or at the feeding batteries.

Leukemia

Leukemia of chickens was first recognized as a distinct pathological entity, in 1908, by Ellerman and Bang, who attributed it to a filtrable virus. Other investigators, however, have been uniformly unsuccessful in attempts to reproduce the disease with Berkefeld-filtered tissue emulsions from leukemic fowls, and therefore deny its true filtrable nature. Henschen attributes the characteristic lesions to a chronic tissue intoxication resulting from a secondary anemia. Berkhardt goes as far as to aver that the disease manifestations of leukemia may be ascribed to a very slowly developing form of tuberculosis. The cautious assertion of Hutyra and Marek that "the etiological role of an ultravisible microorganism *does not appear excluded*" betrays a shade of misgiving on the part of these authorities that might commend the disease to the further consideration of science. The increasing

prevalence of a specific gallinaceous leukemia in the United States renders it imperative that further study be made of the nature of the disease and methods for its control.

Paralysis

In a discussion of this broad nature it would be impossible to overlook the economic importance of fowl paralysis. To quote from the paper presented on this subject before the disease section of the World's Poultry Congress, at Ottawa, Canada, in 1927, by Pappenheimer and Dunn, "The disease which is known to poultrymen by the indefinite and rather unsatisfactory name of fowl paralysis merits far more intense study than it has received."

These authors, and also Doyle, note that the essential lesion of the disease consists of cellular infiltrations, principally of the nervous structures, and of the iris and cornea of the eye. The invading cells are largely lymphoidal or mononuclear in type. Doyle was unable to produce the disease experimentally, but recognized its contagious nature, and attributed it to "a neurotropic virus of some kind," presumably transmitted through breeding from affected flocks. Pappenheimer and Dunn obtained some experimental results suggesting the possibility of a filtrable virus as the etiological factor.

In a popular paper dealing with the disease, Stafseth attributes those outbreaks of paralysis observed by him to the presence of a duodenal type of coccidium. The present writer observed at least one outbreak in which the duodenal coccidium was invariably present in immense numbers in all affected birds autopsied, in conjunction with numerous punctiform ulcerations of the duodenal mucosa. In another outbreak observed by him, however, the presence of the coccidium was noted in only about half of the cases. Many of the others showed duodenal lesions of a more or less diffuse nature, from which numerous very minute tapeworms, barely visible to the naked eye as whitish specks, could be recovered. This species of tapeworm was identified as *Davainea proglottina.*

Pappenheimer and Dunn stated that their studies offered "no support for the widely prevalent view that the disease is in some way associated with coccidiosis or with verminous infestation." Further research may definitely relieve these parasites of primary etiological suspicion, but should the nerve lesions (and symptoms) be shown to have relation to some form of chronic intoxication

of enteric origin, there would still remain the speculative possibility of a secondary role played by intestinal parasites in the production of mucous abrasions of the duodenum, providing the potential port of entry necessary to complete a hypothetical chain of evidence. This conjecture harmonizes with Doyle's neurotropic virus theory, also with his inability to "find any agent in the tissues, by cultural or staining methods, with sufficient constancy to make any demonstrable microorganism appear significant so far as the cause is concerned."

Conclusion

On September 17, 1928, a committee from the National Poultry Council, in conference with Gen. H. M. Lord, Director of the Federal Budget at Washington, D. C., stressed the importance of practical research in the control of poultry diseases vitally involving the welfare of the industry from all angles, making particular mention of some of the conditions spoken of in this paper. There probably has never been a time when the industry itself was more alert to the importance of poultry diseases and more eager to lend its support and cooperation to the scientific investigation and administrative helpfulness concerning these diseases, than today. This fact presents an unusual challenge to the research worker along these lines, involving at once a profound responsibility and a golden opportunity. That science is awakening to the full significance of these, none can doubt.

It has been the writer's aim to emphasize some of the salient points of this situation. He is deeply conscious that this discussion has been incomplete, disconnected, and in some measure disproportionate. That it was colored by the variable elements of individual viewpoint was inevitable from the very nature of its matter.

If, notwithstanding, it has been heard in the spirit of a friendly interest in the advancement of the science of poultry pathology, if it may provoke a constructive discussion or consideration of the problems referred to, if in ever so small a way it may give encouragement to the quest for new knowledge concerning those problems, the writer shall consider himself fully rewarded.

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President Cary: The next paper to come before us, and I must ask the author to be as brief as possible, is by Dr. James E. Rice, Professor of Poultry Husbandry, Cornell University, Ithaca, N. Y., on "The Responsibility of the Veterinarian in Official Poultry Disease Eradication."

(Prof. Rice delivered an extemporaneous address, illustrated with a number of charts, to which he made frequent references. Copies of the charts were not received for reproduction with the address of Prof. Rice. A copy of the transcript of his address was sent to Prof. Rice, to be edited and put in shape for publication, but this has not been returned up to the time of going to press. Editor.)

President Cary: The next will be the report of the Committee on Poultry Diseases. The Committee will make some recommendations covering this subject.

Dr. Robert Graham: In order to save time I am going to omit reading the discussion in the report of the Committee and simply read to you the summary.

. . . Dr. Graham read the summary of the report. . . .

REPORT OF THE COMMITTEE ON POULTRY DISEASES

Dr. Robert Graham, *Chairman*, Urbana, Ill.

Dr. W. R. Hinshaw, Amherst, Mass. Dr. Joseph P. Scott, Manhattan, Kans.
Dr. I. D. Wilson, Blacksburg, Va.

The importance of hygiene in maintaining profitable flocks is so generally conceded by sanitarians that your committee has confined its report to certain phases of bacillary white diarrhea and avian tuberculosis control. Campaigns against these diseases, though based largely upon sanitary measures, must be supported by comprehensive investigational programs. More knowledge of the causative agents, their abodes in nature, with the avenues by which they are perpetuated from fowl to fowl is essential. The fundamentals in the control of these and other diseases are known, but scientific facts rather than opinions must be accumulated by carefully controlled research to guide safely the development of an efficient poultry-disease-control program. It is the opinion of your committee that the importance of avian pathology from an investigational standpoint is fully recognized by federal and state officials as well as allied interests of the poultry industry. As a result of this understanding the investigational work is being prosecuted as rapidly as funds will permit.

The Committee on Poultry Diseases of this association has emphasized for two consecutive years the importance of uniform sanitary regulations as well as the necessity of standardizing the agglutination test for bacillary white diarrhea. Last year the Committee, after careful consideration, made certain recommendations to restrict the use of the word "accredited" to disease control. Sanitary officials in twenty-three states have adopted or favor this terminology to prevent further confusion between breed improvement and disease-control work. Notwithstanding lack of uniformity in regulations and definite standards in testing for bacillary white diarrhea, progress has been reported in different states.

Bacillary White Diarrhea

A survey of the status of bacillary white diarrhea control in the United States, to be presented briefly in this report, is based upon the information supplied by state officials in answer to thirteen questions prepared by your committee. The summary, though incomplete, gives a general idea of the widespread interest as well as the prevailing variance of official terms and technical methods of procedure. Following the initial investigations of Rettger and Jones, testing of breeding fowls was employed by flock-owners and hatcherymen. The demand for healthy breeding stock and chicks free from bacillary white diarrhea has been a potent force in the campaign against this and other diseases. It is also apparent that the interest and desire of the owner will continue to be an important factor.

In all, twenty-four states reported as being officially engaged in suppressing bacillary white diarrhea or as having outlined advisory plans for the guidance of the poultry industry. In one state the work has been under way fifteen years, while in others the program is relatively new. The average time of the twenty-four states engaged in the work is 4.6 years. It is therefore apparent that the program as a whole is in the formative stages though last year approximately 2,000,000 fowls of breeding age were tested under supervision. This represents but a small percentage of the total breeding fowls in the United States, though it fails to include an ever-increasing number of flocks privately tested.

Nothwithstanding occasional reports to the contrary, the practical results obtained in the suppression of bacillary white diarrhea greatly overshadow irregularities that have been reported. Apparent discrepancies or failures of the test serve only to emphasize the need of proper supervision. Some of the failures of the test seem traceable to lack of standardization of technic, while infected incubators, insanitary feeding and housing practices are doubtless important factors. A successful campaign against bacillary white diarrhea must be comprehensive, of uniform procedure, and painstaking in all its phases.

A standard test must be applied by trained persons. Reactors must be removed. Incubators and brooders must be properly disinfected. Clean ground to prevent reinfection must be provided. Twenty-four state officials indicated that testing and elimination of reactors had helped in the control of bacillary white diarrhea as judged by a reduction of reactors in retests and livability of chicks. The infection in mature stock was, according to reports, frequently reduced from 10 to 2 or 3 per cent, while many flocks were freed from the disease.

Uniform Procedures

Though uniformity of procedure is an outstanding need in a campaign of this character, there can be no doubt that progress has and is being made in the control of pullorum infection and that the value of the agglutination test, in the judgment of your committee, is definitely established. It is also the unanimous opinion of your committee, notwithstanding certain limitations of the agglutination test, that expressions condemning the test as worthless are not only misleading but detrimental to the poultry industry. The members of the Committee regard it as unfortunate that a limited number of disconcerting results which illustrate possible discrepancies (not, however, peculiar to this test) have been exploited to the public to confuse the poultryman temporarily. The situation calls to mind the controversy many years ago on the value of the tuberculin test in cattle. The agglutination test, if properly employed, represents, in the opinion of your committee, the only successful method of diagnosing bacillary white diarrhea in mature fowls and it seems that the results of testing and isolation of reactors obtained to date justify confidence in the test when it is properly applied.

Sanitation

In connection with testing, a vigorous extension of sanitation programs is needed. Clean eggs, clean chicks, clean incubators, clean ground, clean houses, clean feed and clean water are essential measures of prevention. Sanitation becomes the responsibility of the owner guided by the sanitarian. The testing of flocks to reduce bacillary white diarrhea infection is recognized as a task for the trained person. Testing for advertising purposes should be discouraged. Stated in another way, testing for bacillary white diarrhea is a disease control measure, not an advertising scheme to sell chicks. To prevent misunderstanding regarding the purpose of the test, sanitary officials must continue to emphasize the value of the test as well as its limitations as a disease control measure.

Standardization of Test

Among laboratory workers in different states it is apparent that a great variation still exists in the diagnostic dilution of antigen and serum employed. A variation in the sensitivity of different antigens also may increase discrepancy in tests. There is little question, in the opinion of your committee, but that the antigen may easily be an important variable factor in different laboratories. The steps taken in New England are commendable and may serve for guidance of laboratory conferences in other localities. Some laboratories regard a dilution of 1:100 as diagnostic, while others employ a dilution of 1:50, 1:40, 1:25, or 1:10. Seven states use dilutions of 1:80 to 1:100; eight states, 1:50; and nine states, 1:25 or less. The macroscopic agglutination test is employed in a majority of laboratories, while a limited number are checking the rapid or slide test as suggested by Runnels and co-workers.*

The testing of all breeding stock before official recognition is given is one procedure in which full agreement was found in different states. There was also agreement that collecting blood samples had little or no effect upon the egg-yield if the fowls were carefully handled. It appears that the cloudiness in tests has been eliminated largely by the addition of sodium hydroxid, as suggested by Mathews.

*Vide "An Application of the Rapid-Method Agglutination Test to the Diagnosis of Bacillary White Diarrhea Infection," by Runnells et al., in the Journal, February, 1927.

Avian Tuberculosis

The results of testing farm flocks for tuberculosis in the Middle West have furnished valuable data regarding the prevalence of tuberculosis. In one state 4,383 flocks, including 691,837 fowls, in twenty-eight counties, have been tested in a preliminary survey. Of these, 27,907 fowls (4.03%) reacted. The prevalence of the infection in old fowls as compared with pullets justifies the general recommendation of disposing of hens after the first laying season. Preliminary results of tuberculin-testing of fowls in the Corn Belt suggest that if the test is properly administered it is a reliable diagnostic aid in suppressing the disease. As an educational procedure in poultry hygiene and live stock sanitation it possesses distinct advantages, though the practical value of the area testing of fowls cannot be appraised on a large scale until more data are available.

Biological Products and Proprietary Remedies

During the past few years many biological products and numerous poultry remedies have been extensively advertised in the farm press. These remedies have been abundantly distributed in many rural districts by itinerant pedlars. Losses either direct from disease or indirect from the exorbitant charges have frequently followed the use of these remedies. The therapeutic value of certain drugs in the treatment of poultry ills is recognized, yet your committee urges educational institutions, veterinarians and sanitary officials to assist in bringing the true value of these products before the poultryman.

Summary

1. A program of research, elimination of reacting breeding fowls, and the application of sanitary measures are regarded as fundamental in the control of bacillary white diarrhea.

2. Persons conducting agglutination tests should be approved by proper state officials. Testers should report periodically to approving or appointing bodies. Veterinarians are urged to enter this field of work in which they are unusually well qualified by their previous training and experience.

3. It is recommended that the agglutination test be considered as the official test, the rapid or slide test being permissible, and that official testing be conducted on a uniform basis. A study of the dilutions used in the agglutination tests in different states shows that a majority use a dilution of 1:25 or less. It is suggested that a dilution of 1:25 be given a trial by those using higher dilutions and that a standard antigen be made available through proper channels to safeguard the testing work.

4. Testing farm flocks in the Corn Belt for avian tuberculosis has yielded valuable information regarding the extent of the disease. As a diagnostic agent avian tuberculin has proven valuable in the removal of thousands of reacting fowls that have been slaughtered under inspection. The elimination of reacting fowls has been followed by disinfection of premises. Your committee recognizes the value of the tuberculin test as well as systematic disposal of fowls in the suppression of this disease.

5. The promiscuous sale of cure-all remedies and biologic products for combating poultry diseases is recognized by your committee as an unnecessary tax on the industry. Your committee recommends that claims made for various remedies be carefully scrutinized by proper federal and state officials in the protection of the poultry industry.

6. The outstanding need in the control of bacillary white diarrhea is a uniform method of procedure. Terminology is important. Standardization of the test is also a matter of concern, but most important of all is the inauguration of a plan under the supervision of federal authorities that will serve in the upbuilding of the industry on a proper basis. In a comprehensive plan of this character it seems logical that live stock sanitary authorities should be best qualified to decide questions of terminology relative to disease control. Your committee therefore recommends to this association that the word "accredited" be confined to official disease control or health programs and not used to indicate culling or other phases of breed improvement work.

President Cary: Gentlemen, you have heard the report of this Committee. What shall we do with it?

. . . It was moved, seconded and carried that the report be adopted. . . .

President Cary: We will stand adjourned until tomorrow morning at nine o'clock.

. . . The meeting adjourned at 5:35 p. m.

ADJOURNMENT

THURSDAY MORNING, DECEMBER 6, 1928

The third session convened at 9:25 a. m., President Cary presiding.

President Cary: We will call upon Dr. D. R. Gillies, B. A. I. Inspector-in-Charge, New York City, to talk about the subject of "Meat Inspection, or the Little Purple Stamp." (Applause)

Dr. D. R. Gillies: I assure you it affords me much pleasure to represent the Meat Inspection Division this morning. My subject will be changed slightly from what appears on the program this morning. I am going to speak to you on the subject of "The Federal Meat Inspection Service."

. . . Dr. Gillies read his paper. . . . (Applause)

THE FEDERAL MEAT INSPECTION SERVICE

By D. R. Gillies, *New York, N. Y.*

Inspector-in-Charge, U. S. Bureau of Animal Industry

I believe it was Mark Twain who said, "A public speaker, to be interesting, must adhere strictly to a certain set of rules, namely: Get up. Talk up. Shut up." These may be explained as follows:

First, get up, so the audience can see you;

Second, talk up, so that your message may be distinctly heard and fully understood;

Third, shut up, while your listeners are still in a receptive mood.

It is my firm intention to adhere strictly to the dictum of this great and noted American writer.

Some three weeks ago, I was advised by Dr. John R. Mohler, Chief of the Bureau of Animal Industry, that I had been selected to represent the Meat Inspection Division of the Bureau at this conference, for the purpose of delivering an address relating to the Meat Inspection Service, using the topic, "The Federal Meat Inspection Service," as a basis for my remarks. This assignment, I assure you, is a most pleasant one and I can conceive of no greater privilege or higher honor than that of associating with this body of men assembled here this afternoon, all

interested and actively engaged in building up and protecting the live stock population of the United States, an industry ranking as one of the largest and most essential in the entire nation.

Some two years ago, in the state of Kansas, a Scotchman owned and operated a blacksmith shop about ten miles from Kansas City. He was very economical in his methods; not stingy, penurious or anything of that sort, not at all, but simply careful and cautious in monetary matters. He was convinced the packers were charging entirely too much money for their meats, so he decided to raise his own. In addition to owning a blacksmith shop and his home, he also possessed five acres of land yielding big crops of alfalfa, so he naturally was immediately filled with a determination to raise rabbits. You all know how prolific rabbits are and how rapidly they increase in number, so shortly after this period, his family ate rabbit three times a day, 365 days in the year. Now, gentlemen, that is some rabbit.

One day the Scotchman was called to Kansas City to attend to some business matters. He placed a young Irishman in charge of his shop during his absence. Twelve o'clock arrived, the good wife rang the dinner-bell and the Irishman hurried to the house for his dinner. The Scotchman was very pious and it was his unfailing custom to say Grace and offer thanks before each meal. The Scotchman being absent on this particular day, the lady of the house asked the Irishman if he would say Grace. He replied, "Sure, Mum," and immediately proceeded in this fashion: "Dear Lord, for the past three years, three times a day, we have had rabbits young and rabbits old, rabbits hot and rabbits cold, rabbits tender and rabbits tough, but thank the Lord we've had enough." So, if the packers are charging too much for their meat, may I not suggest that you all begin raising rabbits.

The Federal Meat Inspection Service—What It Means to You!

The problem involved in maintaining a sound and wholesome meat food supply is, without doubt, one of paramount importance, since it concerns most intimately the well-being of the entire nation. The long-recognized and undisputed fact that certain animal diseases are transmissible and communicable to man makes it imperative for the protection of human health that supervision be maintained over this extremely important industry, namely, the preparation of meat and meat food products.

Meat inspection primarily is a service in hygiene and sanitation, though the first enactments on the subject were based wholly on economic considerations. It developed from an ineffective law, in 1890, to a law embracing one of the most scientific and complete organizations in the world, of real value, and commanding the respect and confidence of all other nations. It is conducted by the Bureau of Animal Industry, under the direction of the Secretary of Agriculture, in accordance with the Meat Inspection Act of June 30, 1906, and rules and regulations promulgated thereunder designated as B. A. I. Order 211 (Revised).

Its objects and purposes are the prevention of dangers which threaten human health, a protection to the meat consumer in an economic relation from frauds and deception, and the detection and location of animal plagues for the protection of the live stock industry of the nation.

Rules and regulations covering meat inspection provide for a thorough and efficient antemortem and postmortem inspection by veterinarians, of all cattle, sheep, swine, goats and horses slaughtered at establishments engaged in interstate or foreign commerce, and a prompt, complete, harmless disposal of all diseases and their specific causes. About 65 per cent of animals slaughtered in this country receive federal inspection.

They further require and provide for an examination by experts of all products prepared from slaughtered animals, relative to their proper origin and desirability as food for man. Provisions also are included for the organization of a force of inspectors, minimum standards for sanitation, supervision of curing, smoking, cooking, shipping and receiving meats. In short, every operation in or about the premises of an official establishment is regulated and controlled, to a certain extent, by the meat inspection laws in force in this country.

The number of official establishments has increased from 1 to 863, located in 258 different cities in the United States. Each establishment is assigned a number. Such designated number is used as a means of identifying products prepared under inspection. To illustrate: number 2 is assigned to Armour & Company, number 3 to Swift & Company, and number 20 to Wilson & Company, and so on for all establishments. This number is registered with the Bureau and must appear on all carcasses and parts, also on containers of meat or meat food products from official establishments. It will be readily observed that a ham from Armour & Company, or any other house, shipped to

Hong Kong, China; London, England, or any other place in the world, can be immediately identified and its origin determined with the greatest degree of accuracy and decisiveness.

The organization has grown from a force of only a few inspectors to the extent that at the present time 4045 employes make up the personnel. This includes Dr. J. R. Mohler, Chief of Bureau, and his assistants, Dr. R. P. Steddom, Chief of the Meat Inspection Division, and his assistants, inspectors in charge of stations, veterinary and lay inspectors. Veterinarians must have had a four-year high school education and must be graduates of colleges having not less than four years of veterinary instruction. In addition to this, they must satisfactorily pass a civil service examination before becoming eligible for appointment as inspectors in the Bureau of Animal Industry.

Even after successfully meeting all these requirements and after appointment is received they are placed on probation for a period of six months, during which time the work they perform is carefully observed and checked in order to determine with reasonable accuracy their fitness and adaptability for the work at hand. Lay inspectors are men especially trained in packing-house procedure and are familiar with operations incident to the preparation of meat and meat food products. They too must pass civil service examinations and likewise serve probational periods.

During the calendar year 1927, 70,705,525 animals were given ante- and postmortem inspection by employes of the Bureau of Animal Industry. Of this number, there were condemned, tanked and destroyed for food purposes 289,031 carcasses, and 1,058,930 parts, and 9,009,132 pounds of prepared meat and meat food products also were effectually destroyed for food purposes. This efficient service cost the American taxpayer only six cents per animal; an expense remarkably low indeed for such a valuable and helpful service.

Where does all this diseased meat come from? Certainly not from the back yards in the cities, but the origin may be traced directly to the farms and ranches. Now then, when you are told that the best hams and bacon come from the farmer's country dressed hogs, stop for a moment and consider this question. Who separates the diseased from the healthy meat in farm-slaughtered animals? What assurance have I that the meat from this source was derived from healthy animals? Gentlemen, there is but one answer and that is meat from healthy and unhealthy

animals is disposed of alike and without special consideration, one over the other.

On the other hand, when you buy meat prepared at any one of the 863 official establishments operating under Federal inspection and supervision, you have not only positive assurance that the meat is sweet and wholesome but you have the assurance, backed by this great government, that it contains no injurious preservatives, that is was derived from healthy animals, and that it was prepared under modern, hygienic and sanitary conditions. So, when purchasing any meat or meat food products for your household use, always look for and insist upon seeing the little purple stamp bearing the inscription, "U. S. Inspected and Passed."

Let me take you through a modern packing-plant and explain how federal inspection is conducted and what it means to the public. And what I have to say regarding this plant applies to every one of the 863 official establishments throughout the United States. As animals are received at the plant, a government inspector must see and examine them all before slaughter is permitted. This is called antemortem inspection and must be thoroughly performed on all animals for the detection of such diseases or conditions that would require condemnation of the carcasses in whole or in part on postmortem inspection.

All passed hogs are driven to slaughter-pens, shackled by the hind leg, hoisted by mechanical means and automatically transferred to a rail or bar where they are bled. They are then dropped into a vat of hot water, where they remain, after which they are passed through a dehairing machine which removes hair and scurf. The hogs are now gambrelled and hung off to a depressing-rail, where all remaining hair and scurf are carefully removed and the heads partially severed, leaving the cervical lymph-glands exposed in their natural position.

It is here that the first postmortem inspection is made. An inspector stationed here repeatedly incises the exposed glands and if any evidence of disease is found the carcass is immediately held and identified by a three-section, numbered, "U. S. retained" tag, securely attached at certain positions conveniently located and in plain view. All carcasses so identified are given special attention and inspection by veterinarians possessing expert knowledge in pathology and specially skilled and experience in performing what is known as final postmortem inspections. Hog carcasses passed at the head inspector's station are now eviscer-

ated and the viscera placed on a sanitary, moving-top, viscera-inspection-table, where veterinarians make a careful and thorough examination of lungs, hearts, liver, spleen and intestines. Carcasses found diseased at this point are "U. S. retained" and handled as previously indicated, the removed viscera and all other parts being identified by means of various sections of retained tags bearing the same serial number.

All hog carcasses passed here continue moving onward, eventually being split and finally given another inspection, which includes an examination of the bones, kidneys, inner walls of the thoracic and abdominal cavities and the entire outer surface of the carcass. If a diseased condition is found, the same procedure as previously mentioned is followed in disposing of the carcass. All carcasses passed are placed in refrigerating rooms, at a temperature of 32° to 36° F., for varying periods of time. They are then cut into primal parts, such as hams, shoulders, loins, bellies, etc. Most of this meat is placed in a curing mixture, where it remains for from 20 to 60 days.

Following this process, the meat is soaked in water, washed under a spray of water and placed in a smokehouse for from 12 to 72 hours. During all these processes, the meat is inspected from time to time by inspectors expert in packing-house operations and procedures. If at any time any meat is found to have become unsound or unwholesome, it is immediately condemned and effectually destroyed for food purposes. From the description given, it is not necessary that a person be an expert mathematician in order to know that the ham or bacon you may have had for breakfast this morning from any one of the 863 official establishments received five different inspections before the little, purple, "U. S. inspected and passed" stamp, the Government's mark of approval, was finally applied to the finished product.

What becomes of the diseased and otherwise unsound meat? Let me show you by illustration. Suppose a good steer cost $200.00 and a hog $35.00. Let us assume that three steers and ten hog carcasses are condemned at an official establishment. What assurance have you that those condemned carcasses are not sold to the consuming public? After a carcass is once identified as being "U. S. retained" by means of tags for that purpose, it never leaves the jurisdiction of the government. It is always held under strict supervision by Bureau employes.

Let us see what happens. These carcasses are placed in large tanks, each tag number carefully checked by inspectors who

must actually see the carcass enter the tank. The bottom of the tank is first securely sealed by a Bureau employe, and after all condemned material has been placed in the tank, he must see to it that a denaturing material, approved by the Bureau in advance, is added to the tank in the proportions specified by rules and regulations. The top of the tank is now effectively sealed with Bureau seals and the product completely rendered at a temperature of 288° F., for a period of not less than eight hours, which reduces the material to soap grease and fertilizer.

Now let us take two hams, one from a "U. S. inspected and passed" carcass, and the other from a "U. S. inspected and condemned" carcass, and I defy any man in this audience to point out any mark or sign which would indicate which one is inspected and passed and fit for food and which is condemned and decidedly unfit for food. To the unaided eye, they appear exactly alike in every detail but the deadly bacteria are thriving in one, notwithstanding. This being an undisputed fact, your only safeguard and assurance of a sound, wholesome meat supply is in the little purple stamp reading, "U. S. inspected and passed."

Nor is this the limit or extent to which supervision is maintained over official establishments. At frequent intervals inspectors visit establishments unannounced and collect, for laboratory, chemical and bacterial analysis, samples of meat and meat food products, also spices, cereal, curing mixtures, water, ice and all other materials used in the preparation of meat food products in order to test their purity and fitness for food. Metal containers are even analyzed for the detection of injurious compositions which might render meat or products unfit for human consumption.

Then there are the sanitary requirements. All establishments must be maintained in a sanitary condition. This ruling has direct reference to light, heat, drainage, toilet and dressing facilities, cleanliness of all operations, structurally smooth walls and ceilings, equipment constructed of rust-resisting material and arranged so that all parts are readily removable for cleaning purposes. What happens when official establishments fail to comply with Bureau regulations? Some few years ago, a young lady died in Manchester, England. On her tombstone appeared the following epitaph:

> HERE LIES THE BODY OF SMARTHY PROCTOR,
> SHE KETCHED A COLD AND WOULDN'T DOCTOR,
> SHE COULDN'T STAY, SHE HAD TO GO,
> PRAISE GOD FROM WHOM ALL BLESSINGS FLOW.

If any official establishment refuses to comply with Bureau regulations, we just don't stay. That is, they either comply with the law or the Secretary of Agriculture withdraws inspection and the business of such a concern is at once restricted to local shipments only, within the state.

The most important of all diseases affecting food animals is tuberculosis. About 12 per cent of all hogs and 2½ per cent of all cattle slaughtered at official establishments show lesions of tuberculosis, a disease which, according to authentic statements by eminent scientists and technical investigators, is transmissible and communicable to man. Bovine tuberculosis usually affects the glands and bones of children and the source of infection is usually traceable to milk.

A statement was made by a certain noted scientist in which it is claimed that the small tuberculosis organism has rendered tens of thousands of children permanently crippled and hundreds of thousands of them temporarily crippled. The hunchback you see on the street is the result of tuberculosis in the spine. Even when the progress of the disease is arrested and lesions are rendered inactive, the patient remains crippled. The scars so often observed in the region of the neck in people are the results of operations for scrofula, a disease of the glands caused by tuberculosis organisms.

Last year this Bureau, in cooperation with state officials, tested 39,059,563 cattle for tuberculosis. Of this number, 1,294,102 reacted and were rejected as affected with this disease. This test is known as the tuberculin test and upon careful and thorough study of reliable and authentic records, it was found to be 96 per cent accurate, a truly remarkable result which cannot be disputed by anyone. At the present rate of testing cattle, it is not unreasonable to predict that this country will be entirely free from the ravages of this disease in the not-distant future.

Take this message home with you today: There is no cure for tuberculosis. If, by some unfortunate circumstance, you have a son, a daughter, a sister, a brother or any other dear to your

heart, who is afflicted with this disease and who may have spent time in a sanitarium for a few months or even years undergoing treatment by the attending physicians and who may leave the institution supposedly cured, you may be assured that such is not the case, for they are not cured. Since the beginning of time, when the disease made its first appearance, not a single histological or physiological cell has ever been reproduced in a tissue once destroyed by the tuberculosis organism. The function of this little organism is to kill and destroy tissue. It has no other function.

So, when a patient is dismissed from a hospital as cured of this condition, the facts are that the disease has only been arrested. A fibrous capsule forms around the destroyed area and serves as a wall, separating diseased parts from healthy tissue, thus preventing extension and aggravation of the condition, and allowing persons thus affected to pass through life without any visible defects or apparent inconvenience whatever.

It is reliably estimated that 40,000 Americans died last year from the direct result of tuberculous infection contracted from the cow. I know of no institution, society or organization performing a greater or more valuable and helpful service to the American people than the Meat Inspection Division of the Bureau of Animal Industry. You, gentlemen, are segregating the diseased cattle from healthy cattle and the Meat Inspection Service brings about a separation of the healthy meat from the diseased meat, thereby preventing the spread of disease from animal to animal and from animal to man.

President Cary: Gentlemen, the next speaker needs no introduction to this Association. He has been a speaker on our programs for so long that it is hardly necessary to tell you who he is or what he is going to say, because he can always say it and you need no introduction to him. Dr. Herman Bundesen, of Chicago, will talk to you now. (Applause)

Dr. Bundesen: Mr. President and Gentlemen: It is always a pleasure to come up to talk to you men. Somehow or other, in my career as a public official, I usually have been coming up to see you just about the day after I am ousted from office or the day before I am elected to office. I don't know what is going to happen next year.

. . . Dr. Bundesen read his paper. . . . (Prolonged applause)

WHERE VETERINARIANS AND CITY HEALTH OFFICIALS MEET

By Herman N. Bundesen, *Chicago, Ill.*

I am told that there is a misunderstanding in some sections of the country between veterinarians and city health officials over

their work in connection with the production and distribution of a safe, pure and wholesome milk supply. There is no real good reason for this misunderstanding. Your organization, the United States Live Stock Sanitary Association, gave the answer to this trouble years ago.

Misunderstandings between veterinarians and city health officials have come about in recent years in the nation-wide tuberculosis eradication campaign. If other cities would adopt the plan that is now being operated in Chicago there would be no trouble.

When I was health commissioner of Chicago I had a high regard for the uniform rules and regulations for the cooperative state-federal plan of testing cattle for tuberculosis which was worked out by your association and is now being used throughout the United States. I used it to aid in insuring the people of Chicago against the danger of drinking milk contaminated with tuberculosis germs.

The duties of the veterinarian in the country and the health officials of a city are distinctly different. It is the job of the veterinarian to aid the farmer in maintaining a healthy herd of cattle that produce milk. It is the job of city health officials to see that the milk sold to the consumers in the city is clean, pure and wholesome; and to get such milk the cows that produce it must be healthy. There is the point where veterinarians and health officials of cities meet and there is the point where misunderstandings at times germinate. But the misunderstandings will not come about if each man sticks to his own business and goes about his work to create harmony rather than trouble.

We in the Chicago Health Department started out several years ago to put an end to the tuberculosis germs that were being carried, at times, into this city in the milk bottle. I started at the bottom by centering my efforts on getting rid of the tuberculous cow that produced milk contaminated with tuberculosis germs.

The man who is charged with the responsibility of the health of a city must get at the bottom of things to eliminate them. A health commissioner of a city must go to the country to get rid of tuberculosis that comes from the cow. There is where he meets the veterinarian. There can be cooperation or war when the health commissioner and veterinarian meet in the dairy barns to start the work of eliminating diseased milk cows. In Chicago we began by urging farmers to have their cows tested for

tuberculosis and get rid of the diseased cows. Some were willing to do this, others resented it. Some tested, some refused to permit their cattle to be tested.

It is the business of veterinarians to test the herds and eliminate the diseased animals. That is not a part of the work of the city health official. As health commissioner, I respected the cooperative test plan. We were willing to accept cows that had been tested and found free from tuberculosis under that system. But our obligation to city milk consumers was to see that all of the cows producing milk for Chicago had been tested and passed as healthy animals under the cooperative plan.

That called for a city ordinance which was passed more than two years ago. It requires that all milk sold in the city of Chicago must come from cows tested and known to be free from tuberculosis. Here is where your cooperative state-federal test plan made misunderstandings unnecessary. We adopted a plan, which is still in operation in Chicago, requiring that every dairyman selling milk in the city must furnish the Chicago Health Department with a certificate issued by the official veterinarians in charge of the cooperative testing work. Under that plan there is filed in the Health Department a certificate on every single cow, showing that she has been officially tested and passed and is free from tuberculosis. A cow cannot produce milk for Chicago until that certificate is in the Health Department's files. That is insurance to city consumers that all the milk coming to Chicago is from tested, tuberculosis-free cows.

It was a blessing to the cities of this country when the United States Live Stock Sanitary Association formulated the uniform rules and regulations governing the work of testing cows for tuberculosis under the uniform cooperative state-federal plan. It is backed by the best authorities in the country, which is all the endorsement that any city health commissioner need require.

I would advise every city in the Union to weave into its regulations a system that is linked up intimately with the cooperative tuberculin-test plan worked out by the United States Live Stock Sanitary Association. If a city uses the plan followed in Chicago, it will not only have a safeguard against the danger of tuberculosis in milk but will avoid misunderstandings that spring up when veterinarians and city health officials meet.

President Cary: Gentlemen, I want you to give a rising vote of thanks to Dr. Bundesen for this address.

. . . The audience arose and applauded. . . .

President Cary: The next paper on the program is continuing the subject we started this morning, "Municipal Meat Inspection," by Dr. W. G. Hollingworth, of Utica, N. Y.

. . . Dr. Hollingworth read his paper. . . . (Applause)

MUNICIPAL MEAT INSPECTION

By W. G. Hollingworth, *Utica, N. Y.*

The main thing I am driving at is a sound program of public health for the future, in all its phases, that means cooperation of the heads of the different bureaus of such government. Enhance education to the unenlightened public; be diplomatic—governed by the ideas of right, which can be put into effect if good common sense is used; be obedient, courteous and render service. I thoroughly realize that it is a rather difficult thing for one, who acts impartially, to do exact justice to both sides, when entertaining strong convictions in controversial questions.

The title of my paper, "Municipal Meat Inspection," I will change slightly as I see fit.

Meat, in the wide use of the term, is a name given to the flesh of such animals as are used for food, and an animal is a living being endowed with sensation and the power of voluntary motion, consequently, a municipal meat inspector should familiarize himself with meats of other animals used for food besides beef, mutton, pork and veal.

The production of food and the industries engaged in rendering food available for human consumption take a leading place among the world's industries, and, as the quality, quantity and variety of foods come under the public health law, it is up to the health officials to cooperate with food inspectors, who are competent to render a scientific decision as to the value of the same for human consumption.

The importance of food inspection, especially products of animal origin, which are used for consumption, holds out great opportunities. It is in the air, so to speak, It must be emphasized. I am optimistic as to what the future has in store for the veterinarian in regard to this phase of public health, but, he must so associate himself. A veterinarian should be connected with every health department.

My object is now and has been to try and indicate what can be done to prevent or lessen to a much greater extent the diseases of animals that have been and are a menace to human life, and to eliminate, as much as possible, the consumption of unwhole-

some food, and to ascertain, as soon as a communicable disease appears in my community, where the malady originated. Investigate, especially if food is suspected.

Today food is the world's greatest problem, the populace must have the same in order to live; naturally, without such all would starve and die. It must be made safe, and that brought about by inspection.

Food is consumed for the purpose of nourishing the cells of the body. Feeding has no other objective, but to accomplish its purpose, it must be wholesome and must contain just what the cells require, which cannot take place if the necessary ingredients are lacking.

The subject on which I am about to address you will not interest the rank and file of the veterinary profession, I am sorry to say, but this would be a queer world if we all thought alike. However, there is no dispute that there have been great changes in the lives of individuals in this country, brought about by the changes in common life during the last half-century. Nobody will doubt that life is becoming so vastly complicated that it is surely a question how individual liberty can be preserved as well as health, and the health of our country depends on our diet, and it is up to those interested in dietetics to tell us what to eat, when to eat, how to eat, and where to eat.

There are great opportunities constantly knocking at the door of the veterinarian today that were never thought of twenty-five years ago; one of them—the most important—is food inspection. America is governed by public sentiment. You owe a duty to your alma mater, that is, to express yourself at every opportunity. Now, what do I mean? It is this—that you contracted an obligation, when you matriculated at the veterinary college, to live up to the ideals of your chosen profession, just as truly as if you were enlisting in the Army or Navy, and that is contracting an obligation of service and obedience. You have acquired a background of knowledge; you have been trained to use your mind, and by so doing, educated yourself to get correct information, to weigh evidence, to judge the correct foundations, and you are making an obligation to use the facilities acquired for that purpose. You are getting a certain breadth of view, which enables you to respect the opinions of others; you are getting trained in intelligence, which will enable you to see the vast importance of the duty which you assume toward maintaining our public health, and I hope you will have sufficient interest in

the work that lies before us to take part in it, and be more willing to take the trouble for its performance. We must be doers, not critics.

The very first step in the solution of this phase of public health is to determine whether human lives are worth saving, and whether disease is worth preventing. We all know what the attitude of the populace would be to this great vital question—but why is the same so little thought about, and why so neglected? In municipalities where so-called food inspection is in vogue, so to speak, only to get in action when some calamity occurs, and we sit down and think seriously over what can happen, due to the consumption of unwholesome food, and what a human life is worth, it makes one shudder when we realize that public health records of food poisoning do not have to be recorded in the health department except when some serious outbreak occurs. It ought to cause serious thinking of the official heads of our health departments, to come to some conclusion whereby the diseases that occur through the consumption of food tainted by infection or intoxication should be prevented to a very large extent. The science of economics, in time, will realize the great necessity of what inspection of food means to the household affairs, and will advocate the same. What will be the result? Who is the responsible person who can be called upon, who has received the necessary qualifications to make him proficient? There is only one, and that is the veterinarian who has been trained for such work.

The problems of public health which confront the officials, relating particularly to the reduction of the number of cases of preventable diseases that may be communicated to the populace and to the degree of success achieved by the officials (and that depends upon the personnel) will be directly in proportion to the degree in which they educate the public in the principles they are trying to apply; the soundest test of a government, whether federal, state, or municipal, is the care it displays in safeguarding the health and lives under its charge. As animal foods are much more liable to carry infections or possess injurious properties than other goods of the vegetable or mineral groups, the energies of those who are capable of rendering service should deem it a duty to do so.

The hygienic conscience of the people has been aroused. Consequently, a demand is going to be brought forth for clean, fresh, wholesome foodstuffs. As a result, communities are

commencing to realize the necessity of sanitary reforms along this line.

Pure food laws, meat and milk inspection ordinances, and consequently the local surveillance over markets, stores, hotels, restaurants, in fact, any place where food or drinks are handled, prepared, served or dispensed, as well as the health of employes and owners, if they come in contact with the same, are all a part of the general movement to obtain a reasonably decent and safe food supply.

The public knows today more about the food they consume than their forefathers did and are constantly clamoring for more knowledge. Due to the fact that preventive medicine is being tremendously advertised, and rightly so, protection of public health is the most pressing medical question of today, and our civilization depends upon health, and health, to a great extent, depends upon food consumed.

Your health and my health are matters of more than personal interest. They are matters of the greatest public significance, for the power and glory, and the greatness of any nation depends, in a very large measure, on the physical welfare of its people. There is, in fact, no function of government any more important than the protection and promotion of the public health. Health and happiness invariably go together; so do poverty and disease.

Favorable health conditions contribute not only to the enjoyment of living, but to productivity and to prosperity, just as prosperity in turn helps to improve health.

The increase of the longevity of life that has been brought about is, in a large measure, due to the decrease in the mortality of children, which in turn is due to better methods of milk hygiene, and all of these remarkable benefits are due, in a large degree, to the prosperous condition of our people, brought about by education.

The improvement of the health of our children, who are our coming citizens, the future builders of our power and progress, will be developed only to the extent of those who are, or ought to be, proficient, and to the same there is a great opportunity for such benevolent work.

When all is said and done, the real promotion of our national health is up to those of us who are unselfish and who are willing to render service in the cause of right. A person possessed of the highest ideals, who has accomplished achievements, has the fascination of all mankind.

Editorially the *Journal of the American Public Health Association* says: "The statistics for the occurrence of food poisoning in this country are sufficiently formidable to merit careful scrutiny by all concerned with public health."

A man's knowledge of his surroundings and of himself is as old as the race. He has been conscious of it since thoughts began, only by changes in methods has our search changed in all the ages that have passed. By imparting such knowledge to others, we have been able to extend the longevity of life to its present state, and, in all probability, will exceed the same in course of time, due to the fact that our reasoning powers have been developed, and to those, who are peculiarly fitted, associated with what is known as research work.

Again a person of high ideals, who is accomplishing achievements, holds fascination for all mankind There are among us people who, by research have done remarkable work, and such achievements, when put into action, have been the means of rendering great service to public health.

But, how many of us have progressed so far, and reasoned out, and come to understand and appreciate Socrates, who, when walking through the market-places at various times, observing the multitude of wares, and catching the stench of it all, said: "How much there is in this world I do not want." His thought is just as timely today as it was then, and how well it would benefit public health if this idea was universally put into effect. I think he had in mind—and, in fact, he helped to strengthen the foundation upon which rests today—preventive medicine.

The mistakes and blunders of yesterday have passed—we must work today; plan for tomorrow; we can set no limit to our work, but must try and reach the goal. Opportunity is constantly knocking at our doors.

The service that veterinarians are able to render public health is not recognized to the extent it rightly deserves. When a community recognizes the necessity of veterinary service in its application to public health, it immediately becomes popular. It helps to lay the foundation for both the present and future citizens to build a suitable structure to make our country a better and healthier place in which to live.

When the Bureau of Food Hygiene was created in my city, naturally under the Health Department, our Health Commissioner gave me to understand that I would not be limited in my work, and I would have full power, and to use all means that I

possessed to make this needed addition to public health worth while—the sky the limit. Well, that was all I could expect. I made up my mind to give the best that was in me to make this phase of veterinary medicine, such a long felt want in Utica (and we have plenty of company) one of the most valuable adjuncts to our Health Department. I made up my mind I owed a duty to my city, my profession, my alma mater, and family, to render such service for what the ideals of the veterinary profession stand for. If I do not carry out such, then I am not fit for my calling. The great trouble is that members of our profession do not emphasize the need of food hygiene, they do not seem to realize the great necessity of it. What is the cause? I will let our journals answer this problem.

We must remember that our success or failure in life depends upon the discharge of the duties that are assigned to us, and remember that food hygiene is too complex for the untrained individual to meddle with in perfect safety. The necessity of food inspection is one of the most pressing medical questions before the people today, and is getting more acute. It should be kept out of politics.

Dr. Wilbur, past president of the American Medical Association, says it costs, for illnesses to the people of the United States, including loss of earnings, over fifteen billions of dollars yearly. Eight million persons are taken ill every day in the year from various causes, and unwholesome food must be included as one of these. To help check this formidable expense, it will naturally cost money, but whatever that amount is, the same is well spent. We are entering a phase of life enhancement that has been and is at present very much neglected. The problem means hard work for the loyal ones. We must be a group of workers, a duty is awaiting us and that is to render service. Have the courage of our convictions, use more sense and less nonsense, and be governed by the ideals of right.

The quality, quantity and variety of food is one of our most important preventive measures; the vigor and success of our nation rests fundamentally upon its diet, and diet may make or mar public health. Rosenau says: "People should be educated to purchase only foods that have been subjected to competent inspection," and I assume he had in mind the veterinarians.

He also gives various causes whereby food may cause sickness: (1) natural poisons, (2) plant parasites, (3) animal parasites, (4) toxins, (5) putrefactive poisons, (6) special poisons, (7) acci-

dental poisons, (8) amount, (9) metabolism and digestion, (10) composition and (11) anaphylaxis. With such conditions staring us in our eyes, preventive medicine looms high as a distinct object for those who are capable of rendering service. Opportunity is constantly knocking at our doors to call our attention to what is expected of us. If we fail to recognize this good fortune, and a layman is selected, we must not find fault.

One of our most learned medical writers says: "It has become very clear that one of the functions of the veterinarian is to protect the human family against the dangers of meat and dairy products, as well as fish and poultry, and from the maladies of domesticated animals communicable to man."

Now, what has been completed in Utica since food hygiene became operative? At first, one veterinarian and one lay inspector. Now one Chief Veterinarian, two assistant veterinarians, and five lay inspectors, and in due time this force will have to be increased.

The work of food hygiene comprises a variety of subjects. Meat and milk and their products cover the major part of our work. The populace now recognizes the value that is due this department. It is looked up to. It receives recognition. The press every day calls at our office for news items. The amount of meat inspected is equal to about 15,000,000 pounds yearly. Of that amount about 250,000 pounds are condemned and sent to rendering plants. We follow the regulations of the federal Bureau of Animal Industry. We have educated our people to look for the purple stamp "Inspected and Passed," either federal or municipal. They know that with that insignia noticeable, the authority back of it stands for the healthfulness of the product. And if, perchance, a carcass of meat should get by and find its way to the market, we hear of the same immediately, due to the fact that a good friendly feeling exists.

I made up my mind at the start, if our Bureau was to be a success, we would have to have the respect of a health-respecting public. About 65 per cent of meat products are federal inspected. Meat inspection helped our packing-plants doing an intrastate business. Previous to the establishment of meat inspection in our city, this industry was handicapped to a very great extent in disposing of its products. The Health Department sent word to the packers for a conference in regard to bettering their business. We told them what we intended to do. They were immediately interested. At once we were told they would comply with any

request the Department made. When our organization was completed, I notified cities throughout the State what Utica, New York, intended to do as to meat inspection. Immediate results were noticed. Many favorable replies were received. Some made me their representative, and requested that their municipal stamp be used instead of ours, to indicate that such meat products would meet with their approval. The increased business that resulted from this action made meat inspection an asset to the packers as well as to our city.

There is a great need of state and municipal meat inspection to take care of the meat that does not come under federal inspection. The great quantities of uninspected meat which reach the consumers ought to be alarming to all those who are connected with public health, and this is more particularly known to those places that have an ordinance which is efficient. When I recall conditions that existed in my city—previous to creating food hygiene—it is no more nor less than disgusting, and we had plenty of company. Our public abattoir has been a great success, and is bound to be much more so in the future. It has eliminated a number of killing-places, due mostly to certain conveniences, such as proper cooling facilities, etc. The former way, meat had to be disposed of soon after killing. Beef, especially, will sell better coming out of a cooler.

I am very glad to say that the Department of Health of New York State, in revising its Sanitary Code, has included a section on meat inspection. It was my privilege to be called in counsel with Dr. Brooks, Deputy Health Commissioner, to perfect the same. Health officers, as a rule, are not very keen in regard to meat inspection. They must be educated to the need of it as a public health measure.

What has been done in regard to handling our milk situation we are very proud of. The consumption of milk has been increased from 25,000 quarts to over 60,000 quarts in about two years. About 90 per cent is pasteurized. This naturally means that more milk must be produced to meet the demand, and that means the dairymen must increase the number of cows, especially of a better quality, as they are the mortgage-lifters, and the services of the veterinarian are naturally going to be in more demand. Now, that is just how conditions are working out with us, and what is done in our community will certainly take place in others, if those who ought to be benefited personally will only get out and push.

The addition of the two extra veterinarians is to care for the reinspection of dairies principally, as our state requires one physical examination and barn score annually, but it is up to the Health Department of any community to renew same as often as necessary. Our Grade A raw dairies have a monthly inspection. We ask the producers to eliminate all cows suffering from contagious abortion, which they readily have done, assuming that undulant fever may be caused by the *Bacillus abortus* transmitted through milk or its products.

I feel that if consumers are willing to pay the price for a high grade of milk, they should be satisfied that it comes from healthy cows. With that confidence, the public is only too glad to be served. Our city budget cares for all the expenses of milk, dairy and meat inspection, feeling that whatever expense is incurred in maintaining public health should be borne by the municipality benefited. A new ordinance has just been drawn up to put under the jurisdiction of this Bureau, the sanitary condition of all places handling food or fluids for human consumption. They must apply to the Bureau of Food Hygiene for permits to conduct such places, and it will be up to us whether one is issued or not.

Our lay inspectors' duties are to reinspect places which handle, prepare, serve or dispense food or fluids. They make around 15,000 inspections annually. The condition of such places today is just the opposite to what it was when this plan of public health activity was started. The proprietors are now anxious to have their places of business looked over. They have been educated, and they find it is good business to be clean. Consumers are more willing to eat meals and purchase foods, due to the more sanitary conditions that exist. A rivalry has been developed, to the extent that one tries to outdo the other. The head of this Bureau is invited to attend their meetings, and always discussions come up to the benefit of all concerned. The Health Department has made it plain that it will meet these persons on a fifty-fifty basis, and now a perfectly friendly feeling exists. We educate rather than prosecute. They have perfect confidence in the attitude of the Department of Health. All this work directly or indirectly goes to the agriculturist. It is up to him to raise foods necessary for the public to subsist on. In order to produce, he must fertilize the soil, and that comes from live stock; and this consequently leads to the point that the agriculturist and veterinarian must work together. One cannot do without the other. When they both join hands, the result is prosperity.

The veterinarian and public health officials should become more closely affiliated with each other's work, in order to fathom out the problems which are constantly coming forward. To work in unison for a common purpose, the health department needs the support of the public and various professions just as much as these groups need the aid of the health department. It is always desirable for all departments to work in harmony, because to be of the greatest service, one division must, to a certain extent, rely upon the other.

The general attitude towards health has changed perceptibly in the last half-century and, as food has a great deal to do with this, the consumer is going to be more careful in regard to the products he buys and as animal products enter largely into his daily consumption, he is going to look to the veterinarian as his health benefactor. The veterinarian is being more and more closely linked up with human medicine. Indeed, nowadays the one could not exist without the other, as comparative medicine is greatly assisting to solve problems of human diseases.

The guardian of public health, no matter how advanced and well equipped, is obviously not going to prevent death nor is it expected that he will eliminate disease and bring about a condition of affairs in which no one dies except of old age. But with the new knowledge which is slowly and painstakingly being stored for his benefit, with growing armament of preventive and defensive medicines at his command, we may reasonably look to him to restrict, little by little, those forms of illness, whether epidemic or endemic, which destroy the young and hamper or devitalize those in the prime of life. Since most of them are demonstrably and all of them are theoretically preventive, it cannot be accomplished without the sympathy and intelligent support of the community, for the best ally of hygienic science is an educated and health-respecting public.

I quote "The service of live stock to man."

> From fields, mountain-sides and waste lands our domestic live stock garner forage and give it new, useful forms under the magic of animal life. Grass and coarse feed become meat, milk, wool and leather. Meanwhile, humbly picking up seeds and insects from here and there, busy domestic fowls and feathered game supply still other food products. Finally the soft plumage of these creatures gives added relaxation to man's rest and sleep.
>
> The horse and dog, for centuries faithful comrades, perform countless useful duties and add zest to recreation.
>
> Beyond such familiar services of animals to man lie great contributions to the fruitfulness of our soils to medicines, music and myriad needs of household, business and social life.

Thus animals are man's allies in his quest for comfort and happiness and as such they merit the best care and humane treatment.

Finally let us consider that all who aid in improving and safeguarding the nation's live stock enable this great industry to increase the benefits which it returns to mankind.

What about the future? There is success for every one who refuses to recognize defeat. The growth of dairying is justified in the United States. We are consuming more than we produce. We are an importing rather than an exporting nation. Our population is increasing at the rate of approximately 1,500,000 consumers a year and this annual addition requires an enormous amount of dairy products. This demand is going to increase. It seems to me that this association has yeomen's work ahead to render such services as are within its power to help solve this great problem.

That which does not grow, diminishes, and eventually dies. A hundred victories do not guarantee the hundred and first. If we stand still for one moment, so to speak, we should soon go down to defeat. If we do not go ahead, we shall drop behind. If we do not advance, we shall be forced to retreat. We have done little, but we must do better. If we stand still, we are sure to retrograde.

President Cary: The next subject on the program is the report of the Committee on Meat and Milk Hygiene. The Chairman of the Committee is not present, but Dr. George Hilton, of Canada, will present the report.

. . . Dr. Hilton read the report. . . .

REPORT OF THE COMMITTEE ON MEAT AND MILK HYGIENE

Dr. J. P. Iverson, *Chairman*, Sacramento, Calif.

Dr. L. A. Klein, Philadelphia, Pa.
Dr. L. Enos Day, Chicago, Ill.
Dr. George Hilton, Ottawa, Ont.
Dr. H. Busman, Chicago, Ill.

Your committee believe that it is desirable to prohibit, as far as possible, the sale of milk from cows affected with any milk-borne disease transmissible to man. We cannot hope to obtain a safe milk supply unless the cattle producing the product are healthy and are maintained under sanitary conditions and unless the milk is rapidly cooled, is held at a low temperature, is kept in sterile containers, is capped and delivered to the consumer in the most sanitary manner possible.

Even under such conditions it is often difficult to deliver the milk to the consumer in the most desirable condition. Even with healthy cows and perfect methods and equipment, such milk-borne diseases as typhoid, scarlet fever, septic sore throat and diphtheria infections do occasionally occur, in addition to the possibility of other diseases which are at present under investigation and study, and concerning which inflicting evidence is accumulating.

While correct pasteurization affords protection to the consumer, and authorities have stated that it is an important factor of safety, it is admitted to be only a factor in safeguarding the milk supply.

As milk is the only animal food used in the raw state, it is of paramount importance that it reaches the consumer in a clean and wholesome state.

Your committee is of the opinion that milk from reacting cows should not be permitted to be sold for human consumption and, while it realizes that at this time difficulty would be experienced in enforcing regulations for this purpose throughout the country, it is of such vital importance that it is our duty to encourage and recommend the passing of legislation with this object in view.

The increasing number of municipalities passing ordinances to limit their milk supply to tuberculin-tested cattle is an evidence of public awakening and is a valuable procedure for the protection of public health.

The value of correct pasteurization as an additional protective measure is also recognized and your committee is of the opinion that the fullest publicity should be given to the necessity of exercising the greatest care in the supervision of pasteurization methods and believes that greater uniformity in the procedure will result in increased protection to consumers.

As it is apparent that correct pasteurization is impracticable in many rural districts, the sooner our milk supply is limited to healthy tuberculin-tested cattle, the better will it be for the health of the nation.

Concerning meat inspection, your committee believes that in many states a large field in this phase of public health activities has not received the attention warranted. Meats and products thereof for interstate or interprovincial movement bear the stamp of the Bureau of Animal Industry and that of the Health of Animals Branch. Many cities conduct municipal meat inspection in a most satisfactory way. In many communities, however, especially in the rural districts, including cities of considerable size, that portion of the meat supply obtained from local slaughterers unfortunately is too frequently produced under improper sanitary conditions and without inspection.

That great progress can be made in the improvement of the prevailing situation is evidenced by the work in several states. It is suggested, therefore, that other states give study to this problem with a view of adding a further safeguard to the health of meat consumers.

Dr. Hilton: I request that this report be adopted.

. . . The motion was seconded, put to a vote and carried. . . .

President Cary: We shall now go to the other division and the first paper on this subject comes from a state in the South that has completed the work of tuberculosis eradication, by the State Veterinarian, Dr. William Moore, of Raleigh, North Carolina. (Applause)

. . . Dr. Moore read his paper entitled, "North Carolina an Accredited Tuberculosis Free State." . . . (Applause)

NORTH CAROLINA AN ACCREDITED TUBERCULOSIS-FREE STATE

By William Moore, *Raleigh, N. Car.*
State Veterinarian

On October 1, 1928, tuberculin tests of all cattle in the 100 counties in North Carolina were completed and the entire state was placed in the modified accredited area.

Tuberculosis eradication in animals was inaugurated in North Carolina in 1918, in cooperation with the U. S. Bureau of Animal Industry, under the accredited-herd plan. For three years, or until 1921, we worked under this plan, testing most of the larger pure-bred herds and the herds supplying milk to our cities and towns. We believed it advisable to test these herds because breeding stock from the pure-bred herds was being used to

establish other herds and it was imperative that our dairy herds supplying the cities and towns should be free of tuberculosis.

From a preliminary survey it was known that our greatest infection was in these herds, due to the importation of additions from infected herds. Cattle had been added to these herds over a period of years when there was not the general knowledge regarding tuberculosis that now exists, nor the adequate state and federal regulations which we now have. In some of these herds the infection was very heavy, but by 1921 most of them had been cleaned up and the practicability of eradicating tuberculosis from a herd had been demonstrated and interest in the eradication of this disease had been aroused.

In 1921 there seemed to be sufficient understanding and demand for us to attempt to eradicate bovine tuberculosis under the area plan. The two most important reasons for the eradication of this disease were: (1) To prevent the economic loss through decreased productiveness and premature death of animals, and (2) for the protection of the public health.

Athough tuberculosis in cattle is usually chronic and seldom diagnosed except by the application of the tuberculin test, yet cattle so affected showed a decrease in productiveness, the owner frequently finding it necessary to dispose of such animals, perhaps not realizing that he was selling a tuberculous animal which would spread the disease to other animals. Many animals died prematurely as a result of tuberculosis. Meat-producing animals failed to make proper gains and many were an entire loss when finally marketed. A review of the meat inspection records of the U. S. Bureau of Animal Industry indicates the loss which is sustained.

Early in our testing work we were told by some that a campaign of tuberculin-testing would result in a decreased consumption of dairy products, due to fear and misunderstanding of this disease. This assumption has been proved entirely incorrect, as the consumption of dairy products in North Carolina has greatly increased during our campaign of tuberculosis eradication and I know of no place in the State where dairy products may be lawfully sold from cows that have not been tuberculin-tested. No owner of live stock can afford to keep animals affected with tuberculosis and he cannot know they are free of this disease except for the proper application of the tuberculin test. Our percentage of tuberculosis in all cattle was known to be small,

but it was realized that in order to locate the diseased animals and remove them it was necessary to test all cattle.

Although the office which I represent is not engaged in public health work, the question of the transmission of bovine tuberculosis to humans naturally entered into our campaign of tuberculosis eradication in animals. Scientific investigation has definitely established that bovine tuberculosis is transmissible to the human, especially to children. The only difference of opinion between those who are really qualified to speak seems to be in the methods of transmission and the amount of human tuberculosis that is a result of infection from animals.

Few persons have the opportunity, inclination or ability to make sufficient investigations to enable them to speak with authority from personal knowledge of the transmissibility of this disease. We accept without question many facts in every-day life, of which we have less personal knowledge than of this subject. It seems to me that sufficient scientific investigation of this subject has been made by those who are thoroughly qualified. These authorities have spoken in no uncertain terms, a few of which I quote.

E. C. Schroeder, in B. A. I. Circular 118, says:

> The danger from the presence of tuberculosis among dairy cows is not confined to the use of milk as a beverage. When tubercle bacilli are present in milk they enter the various articles of diet prepared from it, and are especially numerous in butter, in which they may remain alive seven weeks or longer without showing a diminution of virulence. The distribution of tubercle bacilli from tuberculous cattle in a way to endanger human health is not left to chance. It is a commercial, systematic distribution from door to door, or rather from table to table. As long as the use of tuberculous dairy cows is permitted, the manner in which dairy products are distributed will insure that practically every member of the human family is exposed to tuberculosis. This may explain why three European investigators, from their postmortem examination of respectively 1,452, 500 and 100 bodies of persons who died from various causes, found that, among this total, 2,052 bodies—no less than 91 per cent—showed lesions of tuberculosis.

Park, in "Practical Hygiene" (1913) says:

> The relationship between the human and bovine tubercle bacilli leads health departments to the opinion that while programs for the repression of human tuberculosis which take no note of tuberculosis in other animals may be successful, the time to strike for suppression of human tuberculosis cannot come until the program for control of bovine tuberculosis is well advanced.

Dr. C. H. Mayo, in the JOURNAL of the A. V. M. A. for September, 1928, says:

> Today no recognized authorities and few physicians doubt the transmissibility of bovine tuberculosis to humans, but there are still some who minimize the danger even to the extent of opposing the efforts of those who are endeavoring to eradicate the disease from cattle on the ground

that the menace is so slight as not to constitute a public health problem. I am satisfied that the figures I have quoted prove conclusively that the danger of bovine tuberculosis to man is quite sufficient to justify all the effort and all the expenditures to eradicate the disease from cattle and to justify me as Health Officer at Rochester in insisting that all the milk used in Rochester must be from cows negative to the tuberculin test, whether the milk is to be pasteurized or not.

Without question, the impelling motive for bovine tuberculosis eradication in North Carolina was the public health importance of it, and while there were other factors of economic importance, the public health importance far out-weighed these.

There is herewith submitted for publication a report showing the number of cattle tested, number of reactors, number of infected herds, percentage of infection and the cost of the work in each of the 100 counties in North Carolina. To summarize this report, there was a total of 621,403 tests applied, and 2079 reactors on 1504 premises were found. The total cost to Bureau, State and counties was $311,599, less than 50 cents per head, which is a nominal amount, considering that our herds averaged only 2.5 animals per herd.

In twelve of the 100 counties no reactors were found and in four counties only one reactor in each county was found. All tuberculous animals were slaughtered and indemnity paid in accordance with the law. Our state indemnity law provided not to exceed $25.00 for grades and $50.00 for pure-breds. Little infection was found in our native cattle and it is apparent that tuberculosis was introduced into our herds through the purchase of breeding stock. Practically no tuberculosis was found in our swine and poultry, although a large number of tests and inspections were made. Neither have we encountered paratuberculosis.

It was found necessary in only one case to prosecute a cattle-owner in Superior Court for failing to submit his cattle to a test. This owner was convicted and his cattle were tested. We believe this a remarkable record in disease control and eradication work, considering the number of herd-owners with whom we had to deal. To us this is a testimonial of the popularity of tuberculosis eradication work.

In completing the work at this time we have prevented the further spread of tuberculosis and the consequent increased cost of eradication. Practically all of our cities and towns are now requiring the annual test of herds supplying milk to them, the health authorities believing that such action is good insurance against the possible introduction of a tuberculous animal into a dairy herd. Our office will continue to test cattle in cooperation

with the Bureau, because we realize the importance of keeping this disease out. Many of our accredited herds will be continued as such, the local practitioners applying the annual test. We will continue also to test annually the herds of our state institutions and other state-owned herds.

The following report shows the number of cattle tested and the number of reactors by years from the beginning of this work, in 1918, up to the present time:

Year	*Cattle Tested*	*Tuberculous*
1918	4,358	104
1919	7,445	168
1920	10,389	219
1921	23,402	385
1922	114,296	785
1923	104,030	499
1924	127,253	467
1925	135,222	472
1926	91,514	313
1927	104,793	229
1928 (10 mos.)	64,990	128
	787,692	3,769

Under the present regulations each of our counties must be reaccredited at the end of three years from the date on which it was accredited. We believe that a county which, on the first test, had less than ½ of 1 per cent infection, should be reaccredited for a period of five or six years on the second reaccreditation test. We cannot justify the expenditure of funds for such frequent tests when other important animal disease problems are urgently in need of attention. It is hoped that the Committee on Tuberculosis will thoroughly consider this matter.

It was our understanding that the packers would pay a premium on hogs shipped from modified accredited areas. Our farmers are shipping a large number of hogs, but not one of them, as far as I know, has received this premium. I hope that this Association can and will help us to secure such recognition.

We are indebted to many for making the completion of this work in North Carolina possible. To the many Bureau, state, county and municipal veterinary inspectors who did the actual testing is due full credit, for their loyal support and faithful service in carrying this work to completion. On them rested an immense responsibility which they assumed and disposed of satisfactorily, often under very trying and adverse conditions. We received the hearty support and cooperation of our practicing veterinarians and a large part of the testing was done by them.

TABLE I.—*Data on cattle tested in 100 counties in North Carolina and cost of the work*

County	Cattle	Reactors	Infected Herds	Reactors (%)	Spent by Bureau, State and County
Alamance	10259	21	15	0.2	$ 5829.00
Alexander	4133	7	7	0.17	1279.00
Alleghany	6640	3	3	0.04	3817.00
Anson	8516	22	20	0.3	4226.00
Ashe	16921	19	17	0.11	6848.00
Avery	4539	6	6	0.13	2266.00
Beaufort	2956	0	0	0.0	1723.00
Bertie	1956	0	0	0.0	1663.00
Bladen	3868	0	0	0.0	2364.00
Brunswick	2056	6	6	0.29	1368.00
Buncombe	21848	101	70	0.46	12999.00
Burke	4915	9	5	0.18	3278.00
Cabarrus	10573	27	12	0.26	4562.00
Caldwell	5869	20	17	0.34	3094.00
Camden	1807	1	1	0.05	1372.00
Carteret	1766	0	0	0.0	827.00
Caswell	3954	4	4	0.1	1437.00
Catawba	8360	10	10	0.01	3400.00
Chatham	7063	13	12	0.18	3654.00
Cherokee	5345	8	8	0.15	2712.00
Chowan	1615	16	14	0.9	1295.00
Clay	3005	4	4	0.1	1221.00
Cleveland	11595	25	23	0.21	5244.00
Columbus	3964	6	6	0.15	1860.00
Craven	2410	14	8	0.58	1192.00
Cumberland	4804	23	8	0.48	2400.00
Currituck	2598	3	3	0.1	1274.00
Dare	2306	11	5	0.48	1504.00
Davidson	11008	23	15	0.2	5586.00
Davie	6534	21	20	0.3	3360.00
Duplin	5748	2	2	0.03	2703.00
Durham	6458	88	29	1.2	2062.00
Edgecombe	4620	28	14	0.6	1804.00
Forsyth	8039	45	31	0.5	5712.00
Franklin	7352	37	8	0.5	3273.00
Gaston	8909	60	17	0.6	4041.00
Gates	1559	0	0	0.0	721.00
Graham	1764	3	3	0.15	1364.00
Granville	7035	13	13	0.18	4024.00
Greene	2670	0	0	0.0	1439.00
Guilford	16283	51	34	0.3	7749.00
Halifax	6815	12	8	0.1	3400.00
Harnett	5002	4	3	0.08	2619.00
Haywood	13541	34	30	0.25	6363.00
Henderson	7425	43	42	0.5	3145.00
Hertford	1941	0	0	0.0	1126.00
Hoke	2306	13	2	0.5	1211.00
Hyde	2388	1	1	0.04	1176.00
Iredell	12924	15	11	0.1	6054.00
Jackson	7397	22	21	0.3	3763.00
Johnston	8843	45	23	0.5	4779.00
Jones	1625	1	1	0.06	741.00
Lee	2880	18	18	0.6	1839.00
Lenoir	2697	3	3	0.1	1385.00
Lincoln	4935	10	10	0.2	2477.00
McDowell	5031	2	2	0.04	3223.00

County	Cattle	Reactors	Infected Herds	Reactors (%)	Spent by Bureau, State and County
Macon	8986	58	55	0.65	4481.00
Madison	13053	38	37	0.29	6990.00
Martin	2503	5	4	0.1	1336.00
Mecklenburg	22760	349	223	1.5	9390.00
Mitchell	4803	10	8	0.2	2438.00
Montgomery	2772	6	6	0.2	1787.00
Moore	5460	12	11	0.2	2444.00
Nash	5237	2	2	0.04	2602.00
New Hanover	2563	17	13	0.6	1200.00
Northampton	4803	6	6	0.1	2316.00
Onslow	2351	0	0	0.0	1157.00
Orange	5412	24	8	0.44	2209.00
Pamlico	1446	0	0	0.0	749.00
Pasquotank	3398	4	4	0.12	2037.00
Pender	3726	18	13	0.5	1440.00
Perquimans	2416	10	9	0.4	1243.00
Person	5601	7	7	0.1	1973.00
Pitt	4620	10	10	0.2	2035.00
Polk	2833	4	4	0.1	1202.00
Randolph	10598	26	24	0.25	5689.00
Richmond	4719	11	10	0.2	2214.00
Robeson	7964	56	34	0.7	5870.00
Rockingham	8569	11	6	0.1	4567.00
Rowan	14280	56	47	0.4	9000.00
Rutherford	8328	9	8	0.1	4565.00
Sampson	4924	1	1	0.02	3081.00
Scotland	2867	11	11	0.38	1920.00
Stanly	7664	20	6	0.2	2888.00
Stokes	5870	7	3	0.1	3268.00
Surry	9597	38	33	0.4	4867.00
Swain	3748	8	8	0.2	2264.00
Transylvania	4770	14	13	0.2	2324.00
Tyrell	1075	0	0	0.0	375.00
Union	16077	139	124	0.8	6898.00
Vance	3578	7	7	0.2	2056.00
Wake	14138	32	31	0.2	6349.00
Warren	7340	13	13	0.1	3435.00
Washington	1404	0	0	0.0	633.00
Watauga	8262	13	13	0.16	4426.00
Wayne	5038	14	12	0.2	2507.00
Wilkes	11233	23	18	0.2	5472.00
Wilson	4051	0	0	0.0	2577.00
Yadkin	4713	11	11	0.23	2328.00
Yancey	6384	6	6	0.09	2850.00
Grand Totals	621,304	2079	1504		$311,599.00

We will depend upon them in the future to keep out infection, because they will test annually many herds to which cattle from outside the State will be added.

Our state and local health departments, the State College, especially the Dairy Department and Experiment Station, business and civic clubs and many other individuals and agencies gave their support and cooperation which was needed and which

was of assistance. It is needless to add that in this campaign, as well as in other disease eradication campaigns, such as tick eradication, the services of the U. S. Bureau of Animal Industry were indispensable. We appreciate their splendid cooperation and the many courtesies and considerations extended to us.

PRESIDENT CARY: If there is no discussion we will go to the next paper. The next speaker is Dr. L. Van Es, of the Department of Animal Pathology, University of Nebraska, Lincoln, Nebraska, who will speak on the subject of "Heterologous Tuberculous Infection." (Applause)

. . . Dr. Van Es read his paper. . . . (Applause)

ON HETEROLOGOUS TUBERCULOUS INFECTION

By L. VAN ES, *Lincoln, Nebr.*

Director, Department of Animal Pathology, University of Nebraska

The subject of the interrelations of the various types of tuberculous infection has been so often presented to this group that it will scarcely be necessary to do more than to recapitulate what, to many of you, is common knowledge. For this, however, there may be some warrant. In the first place the importance of infection by heterologous bacillary types must be constantly kept in mind and in the second place a word of caution may be useful in connection with a need for more correct estimates of the part actually played by tubercle bacilli as causes of disease in animal species other than those which serve them as their optimum hosts.

A faulty evaluation may cause us to lose sight of the truth and if, in the service in the cause to which we are committed, we are not guided by a full understanding of what is actual, we are apt to fail in our efforts. There is as much danger in overestimation as in underestimation of the part played by a given type of infection as a cause of tuberculous disease.

First of all there is need of prudence if we are inclined to accept even very plausible circumstantial evidence as a base for general conclusions. The coincidence of tuberculosis in a family and in the family milch cow does not necessarily mean that this animal was the primary source of mischief. Of course, this may be a possibility to be reckoned with, but such a transmission can be accepted only if by careful typing experiments the human sufferers were found to harbor the bovine bacillus in their ejecta or lesions. The distribution of sputum by a phthisical subject in

a poultry-yard inhabited by tuberculous fowls is certainly no evidence of the transmission of human tuberculosis to chickens.

The earliest literature on the subject contains much of this sort of evidence and even after a more or less precise typing technic became available, conclusions were not always based on flawless experiments. Useful as the differentiation of bacillary types by culture methods may be, the mode of growth is not always constant and variations are often too difficult to interpret. The evidence obtained from inoculation experiments is less subject to erroneous interpretation. But here also great care is necessary, especially in the typing of avian strains in which fowls must be used. In the face of the marked prevalence of tuberculosis in poultry, extraordinary care must be exercised in the selection of the birds to be used. Not only must they be young and must they be obtained from sound flocks, but they must always be challenged by a tuberculin test. Typing results cannot be valued at par unless evidence of this precaution is definitely presented.

Our conclusion in regard to the part played by the three bacillary types in the course of a statistical review must be based only on accurate typing technic, while in addition all statistical evidence should be brought in its proper relation to the general morbidity among the animal species concerned. A distinction must always be made between qualitative and quantitative findings, inasmuch as there is a vast difference in their relation to actualities.

For instance, there is a difference in the problem arising from the question whether or not bovine tuberculosis is transmissible to man and the one pertaining to the influence of such an infection source on the morbidity rate of tuberculosis in general. In the first instance the problem is qualitative, in the latter it is quantitative, and the two should not be confused.

In order to solve the first problem, we select the cases in which bovine infection is most apt to occur and as a consequence we may find an infection incidence far in excess to what would be found if all cases of the disease were subjected to inquiry. If a certain form of tuberculous disease shows bovine infection in 50 per cent of the cases, this is no warrant for the belief that half of all human cases are due to the same source. This very error nevertheless, is frequently committed, and hence exaggerated statements are made, which, unless promptly corrected, will do damage to sanitary progress. The anti-social forces, always on the alert to make the world safe for any disease, would not be slow

to make use of the erroneous conclusions of sanitary-minded persons in order to block the progress demanded by the latter.

With these considerations in mind it is possible to place a more or less correct estimate on the degree in which intertransmissibility of bacillary types plays a part in the tuberculoses of farm live stock and man.

There is no evidence that the human strain of tubercle bacilli plays a prominent part in the tuberculosis of horses, cattle, goats and sheep, and it can be dismissed as an important etiologic factor in the spontaneously developed cases of the disease among these animals. The human type, however, does occasionally cause tuberculosis in swine under natural conditions. On the whole, it may be stated that the lack of opportunity for infection, the relative avirulence of the organisms, or perhaps an inherent resistance on the part of most of the live stock species concerned, all combine to make the human bacillary strain a rather minor factor among the causes of animal tuberculosis. This, however, must not be regarded as warrant for not taking active precautions when infection channels between man and animals appear to be open. These should always be closed, on the ground that any form of virus transmission must be prevented, no matter what its nature may be.

Fowls are resistant to infection by the human strain of the tubercle bacillus.

In the various forms of tuberculosis of man the human bacillary type must be regarded as the most common cause.

The Bovine Bacillary Type

The bovine bacillary type is endowed with a marked pathogenicity for many species. It constitutes an almost universal cause of the disease in cattle, and in practically all the cases of tuberculous disease in horses, sheep and goats this variety of the organism is the etiologic factor. Bovine tubercle bacilli figure prominently as the cause of swine tuberculosis and this is especially the case in regions where the morbidity rate of cattle tuberculosis is high and where the incidence of avian tuberculosis is low.

The bovine strain of the tubercle bacillus is responsible for most of the cases of progressive generalized tuberculosis of swine.

Bovine Tuberculosis in Man

Tuberculous infection of bovine origin plays a part as a cause of certain forms of tuberculous disease in man. Its pathogenicity

for this species, however, is a restricted one and is particularly influenced by the factors of age and a certain selective susceptibility of certain organs. Bovine infection is most commonly contracted by children up to ten years of age but it becomes relatively rare for the age groups beyond the sixteenth year.

The cases of human tuberculosis due to bovine infection pertain particularly to the extra-pulmonary forms, or the so-called surgical tuberculoses, such as involve bones and joints, lymph-nodes (scrofula), the meninges, the genito-urinary tract and the skin.

As a cause of pulmonary tuberculosis including the bronchial lymph-nodes, the tubercle bacillus of bovine origin appears to play only a very minor part. The literature on the subject records 1164 cases especially examined for the purpose of determining the responsible bacillary types; of these the human bacillary type was found in 1157 cases, the bovine type in only five cases, and in two cases both types were found to be present.

The incidence of bovine tuberculous infection of man is further influenced by the local prevalence of the disease in cattle and no doubt also by the consumption of raw milk. A recent investigation of 60 cases of British extra-pulmonary tuberculosis by Morrison, showed bovine infection in 34, or in more than 56 per cent, and it accounted for 75 per cent of the cases of tuberculous lymph-nodes of the neck.

In the 140 cases of extra-pulmonary tuberculosis typed at the Nebraska Experiment Station, the bovine bacillary type was encountered in only four cases. These results pertained to cases mostly originating in the Mississippi Valley and may, in a manner, reflect the relatively favorable bovine tuberculosis situation of this region. The fact that a large proportion of the cases typed in Nebraska were obtained in Chicago, where a sanitary supervision of the milk supply is in operation, may also be significant when the relatively low incidence of bovine bacillary types in the cases examined is given consideration.

Results of Typing Human Cases

In a recent publication by Möllers (in Kolle and Wasserman's Handbuch) it is shown that there are available the records of typing results of 2562 cases of human tuberculosis, of which 2205 yielded a human bacillary type, 339 a bovine type, while in 18 cases both types could be shown. It may be observed, however, that these results may be subjected to a considerable error factor,

as no evidence is presented that in all cases they are based on the more exact typing method by inoculation into laboratory animals.

In the interpretation of typing results with material like that used in the Nebraska experiments, where only non-pulmonary cases were considered, it is not an easy matter to determine exactly how heterologous infections may affect the general morbidity rate. It must, however, be borne in mind that for the registration area of the United States, the mortality statistics show a relation of pulmonary to non-pulmonary form of the disease of 7.1:1. This seems to indicate that the influence of bovine infection on the tuberculosis death-rate is relatively small. Probably it is, but not so small as mortality data seemingly indicate, because the pulmonary cases are always more apt to contribute to mortality than the non-pulmonary ones. Many of the latter do not influence the death-rate at all and live on until they are finally overtaken by a non-tuberculous cause of death.

It is extremely difficult to express statistically the damage due to bovine infection in the human subject with any degree of precision. We know, however, that while as a general death cause it cannot be compared to infection of human origin, it is not only capable of contributing to the mortality rate, but that it also is instrumental in the causation of a considerable amount of crippling and of chronic, non-fatal disease, conditions which may not be recorded as a cause of death at all. For this reason alone, bovine tuberculosis remains as an actual or potential factor worthy of the attention of those who have to do with the preservation of the public health.

The bovine bacillary type plays no part as a cause of avian tuberculosis.

The Avian Bacillary Strain

The avian bacillary strain is sharply distinguishable from both the mammalian ones, by its pronounced pathogenicity for poultry, a quality not possessed by any of the latter. As far as we know at this time, it is the sole cause of avian tuberculosis in this country. On the other hand avian tubercle bacilli have a certain pathogenicity for certain mammals, although in many of these it causes only benign, non-progressive forms of the disease.

In areas where avian tuberculosis is very common it appears to be a prominent cause of tuberculosis of swine. Some typing results obtained at the Nebraska, Illinois and North Dakota Experiment Stations and which were reported to this organization,

for this species, however, is a restricted one and is particularly influenced by the factors of age and a certain selective susceptibility of certain organs. Bovine infection is most commonly contracted by children up to ten years of age but it becomes relatively rare for the age groups beyond the sixteenth year.

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In the 140 cases of extra-pulmonary tuberculosis typed at the Nebraska Experiment Station, the bovine bacillary type was encountered in only four cases. These results pertained to cases mostly originating in the Mississippi Valley and may, in a manner, reflect the relatively favorable bovine tuberculosis situation of this region. The fact that a large proportion of the cases typed in Nebraska were obtained in Chicago, where a sanitary supervision of the milk supply is in operation, may also be significant when the relatively low incidence of bovine bacillary types in the cases examined is given consideration.

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In a recent publication by Möllers (in Kolle and Wasserman's Handbuch) it is shown that there are available the records of typing results of 2562 cases of human tuberculosis, of which 2205 yielded a human bacillary type, 339 a bovine type, while in 18 cases both types could be shown. It may be observed, however, that these results may be subjected to a considerable error factor,

as no evidence is presented that in all cases they are based on the more exact typing method by inoculation into laboratory animals.

In the interpretation of typing results with material like that used in the Nebraska experiments, where only non-pulmonary cases were considered, it is not an easy matter to determine exactly how heterologous infections may affect the general morbidity rate. It must, however, be borne in mind that for the registration area of the United States, the mortality statistics show a relation of pulmonary to non-pulmonary form of the disease of 7.1:1. This seems to indicate that the influence of bovine infection on the tuberculosis death-rate is relatively small. Probably it is, but not so small as mortality data seemingly indicate, because the pulmonary cases are always more apt to contribute to mortality than the non-pulmonary ones. Many of the latter do not influence the death-rate at all and live on until they are finally overtaken by a non-tuberculous cause of death.

It is extremely difficult to express statistically the damage due to bovine infection in the human subject with any degree of precision. We know, however, that while as a general death cause it cannot be compared to infection of human origin, it is not only capable of contributing to the mortality rate, but that it also is instrumental in the causation of a considerable amount of crippling and of chronic, non-fatal disease, conditions which may not be recorded as a cause of death at all. For this reason alone, bovine tuberculosis remains as an actual or potential factor worthy of the attention of those who have to do with the preservation of the public health.

The bovine bacillary type plays no part as a cause of avian tuberculosis.

The Avian Bacillary Strain

The avian bacillary strain is sharply distinguishable from both the mammalian ones, by its pronounced pathogenicity for poultry, a quality not possessed by any of the latter. As far as we know at this time, it is the sole cause of avian tuberculosis in this country. On the other hand avian tubercle bacilli have a certain pathogenicity for certain mammals, although in many of these it causes only benign, non-progressive forms of the disease.

In areas where avian tuberculosis is very common it appears to be a prominent cause of tuberculosis of swine. Some typing results obtained at the Nebraska, Illinois and North Dakota Experiment Stations and which were reported to this organization,

showed that the greater part of the cervical and mesenteric lymph-node lesions found in an extensive region were caused by avian infection.

These non-progressive lesions are the ones principally responsible for the increase in swine retentions beginning with 1907 and apparently this increase was keeping pace with the enormous spread of avian tuberculosis within the territory concerned.

Less is known about the part played by the avian strain of tubercle bacillus in the horse, sheep and goat, owing to the fact that tuberculous disease is not common in these animals and that in this country, at least, the horse is scarcely ever a subject of meat inspection statistics.

Avian Tuberculosis in Cattle

Tuberculous infection of avian origin is by no means uncommon in cattle. In this country it appears to be principally associated with discrete, non-progressive lesions of the mesenteric lymph-nodes. In a carefully selected group of such cases, 113 in number, the Nebraska Experiment Station found avian bacilli to be present in ten of the number, while in four cases both avian and mammalian bacilli were found. The latter also accounted for the 99 remaining cases.

Similar results were obtained in Denmark where, in addition, it was shown that apparently the gravid uterus of cows constitutes an organ of predilection for avian bacilli, which thus became responsible for a number of abortions.

Avian Tuberculosis in man

The avian bacillary type may also be associated with tuberculous disease in man. In the European literature appearing between 1893 and 1923 we find accounts of fourteen cases of avian infection definitely ascertained by successful typing experiments. This evidence, however, may be somewhat vitiated by the fact that it is not always apparent that the freedom from tuberculosis in the typing fowls was challenged by tuberculin tests or that rabbits also were included in the typing series, as an additional measure of safeguarding the final results.

The 140 cases of extra-pulmonary human tuberculosis of the Nebraska experiments already referred to were also typed for avian infection, but no evidence of the latter was encountered and, as far as we know at this time, cases of human infection by avian bacilli, definitely established by proper typing, have not been brought to light in this country.

It is, however, possible that the recently reported findings of an avian bacillary type in cases of Hodgkins' disease throw a new light on the subject. As the detailed account of the typing experiments pertaining to these cases has not as yet become available, it may be prudent to suspend judgment and to await further reports.

As the matter appears at the present time, it is not apparent that there is justification in regarding avian sources of tuberculous infection with any degree of concern from a public health standpoint.

Observations on Sensitization

To what extent heterologous bacillary strains may so sensitize animals that they will react to a homologous tuberculin is not fully known. As far as avian infection is concerned the results obtained at the North Dakota Experiment Station seem conclusive on the negative side. Yet, it is significant that at least half the cases which were shown to harbor only avian bacilli in their lesions, in the Nebraska experiments, were sent to slaughter as reactors to the ordinary mammalian tuberculin.

On this point the opinion of Plum, of Denmark, is more conclusive. He states:

> If in the eradication of bovine tuberculosis the cattle which react to the subcutaneous test with bovine tuberculin are eliminated, the bovine disease only is involved and not the animals which are infected by avian bacilli.
>
> On the other hand the intradermal test with bovine tuberculin will also reveal several cases of avian infection.
>
> The subcutaneously provoked reactions appear to be more specific than intracutaneous ones, inasmuch as cattle infected with various acid-fast bacilli are to a higher degree inclined to react to a heterologous tuberculin intradermically injected.

Plum's inquiry revealed that cattle infected with avian bacilli may react to a subcutaneously applied bovine tuberculin, but such a reaction only rarely occurs, while those after an intradermic application of the same tuberculin are more frequent. This feature, in Plum's opinion, certainly explains why, in stables in which bovine tuberculosis is not to be expected, reactions to the intradermic test may be encountered.

Sensitization by human bacilli must be recognized as an obvious possibility, although as yet there has not been presented a volume of evidence, which permits definite conclusions on this point.

It will probably not be possible to solve this problem of heterologous sensitization with finality until more becomes known about the nature of tuberculin itself.

PRESIDENT CARY: The next paper will be by Mr. John Thompson, Editor of the Iowa Homestead, Des Moines, Iowa, on the subject of "The Agricultural Press and the Tuberculosis Eradication Program." (Applause)

MR. THOMPSON: Mr. Chairman and Gentlemen, I listened to your President while making his annual address yesterday and I came to the conclusion that whatever he says he means. He seems to have a way of making things go home when he talks. So, when he said a little while ago that these people who do not limit their talks to twenty minutes would have to be knocked down, I decided that I would not take up more than twenty minutes because I have some other things to do today. I can't afford to be knocked down. (Laughter)

(Mr. Thompson continued to speak extemporaneously from this point, but submitted the following paper for publication in the proceedings. Editor.)

THE AGRICULTURAL PRESS AND THE TUBERCULOSIS ERADICATION PROBLEM

By JOHN THOMPSON, *Des Moines, Iowa*

Editor, The Iowa Homestead

I am glad to be able to say that there is not a farm paper of any standing in the United States that is opposing the present method of eradicating bovine tuberculosis on the county area plan. Furthermore, based upon information secured through correspondence with the editors of practically every farm paper in the United States, not more than three or four are neutral on this question. The others are all taking a more or less active part in the campaign and have indicated their desire to continue to do so till the entire country shall become one grand accredited area.

That the farm press has been a very important factor in getting the farmer to appreciate the importance of eradicating tuberculosis from our cattle and hogs, and to explain to him the value of tuberculin as a reliable diagnostic agent for this disease, is generally understood and appreciated by those who have the work in charge, yet I doubt whether they realize that they might obtain additional assistance if they cooperated a little more closely with the farm press. I believe that fully 90 per cent of the editors would be inclined to keep the question before their readers to a greater extent than they are now doing, if they were kept in closer touch with the work as it is being conducted out in the field.

The monthly report of progress now being sent out is all right for some purposes, but not particularly well suited for the farm press. Personal experiences from farmers who have owned tested herds for a number of years, as well as comments from such men upon the cost of keeping a herd free from tuberculosis after it has been accredited, would in many cases prove of great

value if given publicity. Other phases of the work might be touched upon to suit conditions in specific localities. In some sections where much prejudice exists against the tuberculin test, experience of farmers who may have followed their reacting cattle to the slaughterhouse would often prove helpful in setting people to thinking a little more rationally on this subject.

Then again, badly diseased, and consequently relatively unprofitable herds, are often found by veterinarians while at work in different parts of the country. When such herds have been cleaned up and healthy herds have taken their place, the owners could undoubtedly report some valuable experience, which, if given publicity, would prove very illuminating to many people who do not appreciate the extent to which tuberculosis cuts down the income of otherwise good herds.

It is not likely that veterinarians would like to be burdened with sending information of this sort to the press, but most of them would be glad to report facts of this sort to state or federal government headquarters, whence the information could then be sent to the farm papers in the state where it originated as well as to county newspapers and the daily press. A person who has had some experience in news writing might well give some time each month to sending out information of this sort to the press in his state and thus keep the subject constantly before the public. A special effort, I believe, should be made to send such material every week to the county papers a month or two before a petition for a county clean-up is to be circulated. Such service might also be continued till the testing has been completed in a given county.

The news furnished should all have a county or state flavor as the case might require. It is true that a well-worked-out service of this sort would cost some money, but if the state and federal governments cooperated in such a project, the expense would be small compared with the benefit that would be derived therefrom in creating favorable public opinion. There is no doubt but that the press as a whole would be glad to cooperate with a news-gathering service of this sort, which should be conducted not as propaganda but as a purely educational program.

Much help might also be secured from state and federal authorities if they were invited to come into a county to explain the whole plan of the work before a petition is to be circulated. Such invitation could be sent by the county agent, the board of supervisors or by committees appointed by groups of farmers and

other citizens who have the interests of agriculture at heart. If meetings were held in every township in a county to show what has been done in other counties, especially in those that have been accredited for several years, there is no doubt but it would greatly facilitate getting petitions for testing signed. Farmers from accredited counties might in some cases prove to be the best men to explain the benefits that accrue from clean herds.

Practically all existing opposition to the tuberculosis eradication campaign is the result either of ignorance of the ravages of the disease and the tremendous annual toll it exacts from the live stock industry, or else a result of the prejudice that exists against tuberculin as a diagnostic agent. These who are most familiar with the method of eradication, however, are its strongest boosters. On the assumption that ignorance of the harm that bovine tuberculosis does, and the true nature of tuberculin, causes 95 per cent of the opposition to the test, plenty of publicity given to both would prove extremely valuable in creating the right kind of public opinion. As soon as farmers understand the true nature of tuberculosis, and that for all practical purposes it really can be stamped out, opposition to the present area plan of eradication will nearly all vanish.

While we are meeting with some opposition to the area plan in Iowa, on the whole we are making splendid progress, already having 44 accredited counties, and before many months have passed half of the counties in the State will be cleaned up. The Iowa law provides for two methods of starting area testing in a county—by circulating a petition among the cattle-owners and by a direct vote of the people of the county at a regular election. The petition plan has been the only one employed till this year, when, at the general fall election, 13 counties voted on this question. Eight of these 13 counties voted to authorize the board of supervisors to levy a tax of 3 mills on the taxable property of the county and to proceed with tuberculosis eradication on the area plan. Five of the 13 counties voted the project down. However, with these eight counties in favor of beginning the work and the several counties in which work is rapidly progressing without any opposition to speak of, there is plenty of opportunity for prosecuting the area work in Iowa for another year and by that time some means will unquestionably be found for cleaning up the few counties that may still hold back.

The following recent letters from Iowa farmers may serve to indicate the kind of material to which publicity might well be

given from time to time in the entire press of the state, as outlined above; such letters would be of especial value if published for a period of two months in counties before area work is to be undertaken.

George C. Burkhardt, Cedar Falls:

It is my opinion that we should test all cattle for tuberculosis in this state and to allow no untested cattle to enter. The time has come when the public demands milk from tested cattle and the sooner the farmer puts himself in position to comply with that demand, the better off he will be. I started to test my cattle 14 years ago and after once getting the herd cleaned up I have never had another reactor. I expect to continue to test my herd periodically, as there is always more or less danger of cattle becoming infected with tuberculosis, especially when one has neighbors with untested herds. I hope that before a great while our county as well as every other county in this state will become modified accredited areas.

W. M. Miller, Dunkerton:

I am a firm believer in the tuberculin test as a diagnostic agent for bovine tuberculosis. I am anxious to see our county cleaned up at the earliest possible moment. I do not favor forcing people to test their cattle because I believe there is a better way, consisting in more thorough educational work. The farmers who are opposed to the test do not understand how it works nor do they appreciate the dangers that lurk in tuberculous herds.

J. Wilbert Miller, Waterloo:

In getting my cattle tested for tuberculosis I sustained rather severe financial losses, but I am perfectly satisfied with the present method of eradicating this disease and I am glad that I own an accredited herd. It took three years to get my herd cleaned up. The majority of the people in this county are in favor of testing and my only regret is that a few individuals should be able to seriously interfere with the progress of this work.

Vern Mellis, Dunkerton:

I am heartily in favor of the eradication of bovine tuberculosis and have been for some time. In fact I have owned an accredited herd for several years. I have never had a reactor since my herd was cleaned up, which makes me feel that when a man exercises reasonable precautions he has little to fear once he has a clean herd. In my opinion the area test is best adapted for cleaning up whole counties at a time. It can be done so much cheaper than when herds here and there are tested at different times. When we farmers of Iowa have freed all our cattle from tuberculosis or practically so, I don't doubt but it will prove of great advantage not only to the breeders of pure-bred cattle, but also to those who sell dairy products on the market.

A. L. Kreger, Cedar Falls:

I began testing my cattle for tuberculosis 14 years ago. On the first test I lost six cows; five years later I lost one more. This last loss can easily be explained. This cow ran in a neighbor's pasture for three weeks one summer and the following year it reacted. My neighbor had never had his cattle tested. When I first began testing we had no indemnity law and I stood my own loss, but the loss was small compared to what it would have been had I waited for government indemnity. There is only one way to succeed with a herd of dairy cattle and that is to make sure that it is free from tuberculosis.

Hugh G. Van Pelt, Waterloo:

We are certainly in favor of the elimination of bovine tuberculosis. We would not remain in the cattle business were it necessary for us to be

fearful of the ravages of this disease. Our herds have been accredited from the beginning and regular testing has made it possible to keep them so with very little expense and with practically no loss. Had we not availed ourselves of the opportunity of cleaning up the herd, our annual losses in the last 17 years would have been large and today we should still have had a herd of diseased cattle instead of one that is absolutely free from tubercular infection. In other words a herd of 200 cattle, which we consider quite valuable, would be almost worthless were it not for the cooperation afforded us by the State of Iowa and the federal Bureau of Animal Industry.

Will Thompson, Waterloo:

I have been testing my cattle since 1911 and under no condition would I introduce an animal into my herd without first testing it on my own farm and keeping it in quarantine until I know it to be free from tuberculosis. The tuberculin test and especially the area method of eradicating tuberculosis are a boon to the live stock industry. I have nothing but praise for the manner in which the veterinarians have done the testing work for me in these many years.

M. T. Humphrey, Waterloo:

I will not tolerate an animal on my farm if there is the least suspicion of its being affected with tuberculosis. I feel that we owe it to the coming generation to take every step possible to eradicate tuberculosis from all our farm animals. I am just as particular about keeping this disease out of my flock of chickens as I am to keep it out of my cattle and hogs.

J. H. Grady, Waterloo:

I have had an accredited herd for three years and under no conditions would I now cease to test my cattle as often as may be necessary to keep them free from tuberculosis.

J. W. McCaffree, Cedar Falls:

I am heartily in favor of eradicating tuberculosis from our herds and flocks and am advocating that policy to my neighbors. I have been testing my cattle for the last 18 years and have had but two reactors in that time. I feel that it is a duty we owe to ourselves, our families and the public to keep our herds free from tuberculosis. It will make no difference to me from now on, so far as my testing is concerned, whether the government pays indemnity or not, my herd will be tested just the same.

M. J. Fowler, Waterloo:

In my opinion, when the time has come that a minority of the cattle-owners can prevent the completion of tuberculosis eradication in a county or in the state, there should be a law passed to compel everybody to clean up. It is a mistake to let a few people interfere with the well-being of a large percentage of the people in a community who are willing and anxious to clean up their cattle. In my 10 years of testing I have lost only three head of cattle. Even in those, no lesions were found, but I understand perfectly that a cow may be affected with tuberculosis and yet show no visible lesions.

J. L. Benizer, Dunkerton:

I have been trying to keep out of this tuberculosis fight because of the feeling that exists in some sections against it, but personally I favor the present area plan of testing, which to me has been very satisfactory. I have always found the veterinarians reasonable and anxious to do their very best in handling a given situation.

Ernest E. Sage, Waterloo:

It will mean money in the pockets of the farmers of Black Hawk County to have their cattle cleaned up and the County declared a modified accredited area. Right now the distributors of milk in Waterloo are pay-

ing 15 cents per hundred more for milk from tested herds. The time is coming when they will accept no milk from cattle that have not been tested for tuberculosis and that is one reason why I am anxious to see the County cleaned up as soon as possible.

C. M. Fobes, Cedar Falls:

I have had an accredited herd for the last three years and am more than glad of this opportunity to express my hearty approval of the eradication of tuberculosis from the herds in Black Hawk County. Let us do everything we possibly can to hold this disease in check.

S. O. Smalling & Son, LaPorte City:

We have owned an accredited herd of Shorthorn cattle for some time. On many occasions we could not have made the sales we did had it not been for the fact that our herd was free from tuberculosis. Had Black Hawk County been accredited during the last three years, as it could have been had objectors not interfered, I feel certain that the farmers and dairymen in this county would have received an additional sum for their meat animals and dairy products in excess of all it will cost to free the entire county from bovine tuberculosis.

President Cary: The next paper will be presented by a man who always gives us something good. Dr. A. E. Wight, Chief of the Tuberculosis Eradication Division, Bureau of Animal Industry, Washington, D. C. (Applause)

. . . Dr. Wight read his paper. . . . (Applause)

PRESENT STATUS OF PROGRESS OF THE NATIONAL COOPERATIVE TUBERCULOSIS ERADICATION CAMPAIGN

By A. E. Wight, *Washington, D. C.*

Chief, Tuberculosis Eradication Division, U. S. Bureau of Animal Industry

The time has arrived for the usual annual report of the nationwide cooperative tuberculosis eradication campaign to be given to this association and to the public. I am very much pleased to submit the following at this time.

This report is naturally of a more or less statistical character, so instead of my reading many interesting facts of that nature, you will be furnished with a pamphlet which contains statistical and other material pertaining to this campaign. Additional copies will be furnished you, if desired.

During the last 12 months we have witnessed the further successful advance of the cooperative campaign to control and eradicate tuberculosis among live stock. The tuberculin-testing of cattle has been the largest feature of the work, there being an average of about 1,000,000 tuberculin tests made each month throughout the varions states. The work has progressed in all its different phases without interruption, except in a few instances.

However, as long as we are engaged in the difficult task of stamping out any infectious disease, which calls for the destruction of the infected animals, there will be an opposing factor in some form or another. Tuberculosis eradication is no exception to this rule, but, notwithstanding the opposition and the criticisms of the work, which at times have been quite severe, its progress has not been impeded to any great extent. It hardly seems possible that at this period in the progress of this important work the opposition could be an important factor. One has but to study briefly the reports and other data available to be convinced of the progress that has been made, and to learn that in many of the states the work is being rapidly brought to completion. It is believed that in the near future more work will be done in other states.

During the next few months the legislatures in nearly all the states will convene and the matter of appropriations for the support of this work, the changing of laws, etc., will be subjects of great importance. There seems to be no reason to believe that the state legislature will not continue to support this campaign in so far as it is necessary. Let us hope that they will continue to lend their support until tuberculosis among live stock is thoroughly under control and eradicated to the greatest possible extent. A splendid spirit of cooperation has prevailed throughout the last year, as it has in previous years and, while we have learned many essential things in connection with the operation of this campaign, we hope that it will be possible to continue to accept improved methods and to put them into practice, if they are found to be beneficial.

Extent of the Disease

In May, 1928, the fourth biennial survey was made by the state and federal authorities in each state, to learn the approximate extent to which bovine tuberculosis existed at that time. This survey indicated a further reduction in the presence of this disease. The first survey of this kind was made in 1922, when 4 per cent of all the cattle was estimated to be tuberculous. This was reduced to 2 per cent by May, 1928. It must be stated that some very significant facts were established as a result of this survey, and one of the most outstanding is that on May 1, 1928, there were only 139 counties, out of a total of 3,072 counties in the United States, where tuberculosis among cattle existed to an extent greater than 7 per cent. Much publicity has been given to this survey, which has made it possible for the people of the

country to become familiar with the progress already made and with the work which still remains to be done.

Accredited-Herd Work

The accredited-herd feature of the project continues to receive a considerable amount of attention, more in some states than in others, but it still remains a feature of national interest and importance.

The records indicate that on November 1, 1928, there were 177,989 accredited herds, which contained 2,302,268 cattle. Recently another survey was made of a large group of non-selected accredited herds to determine what percentage of them failed to pass the annual retest applied during the fiscal year ended June 30, 1928. The result of this study is very interesting. It shows that out of approximately 48,000 herds about 3.7 per cent failed to pass the annual retest. About three years ago a similar survey indicated that 5.2 per cent of fully accredited herds contained reactors on the annual retest. A further study of this question indicates that about 89 per cent of the herds that were found to be infected upon the annual retest were located outside of modified accredited areas. This more forcibly establishes the importance of cleaning up districts in order to avoid exposure to reinfection.

A table which brings out some very interesting points in connection with this study will be found in the pamphlet that I previously mentioned. It may again be said that, notwithstanding our best efforts, occasionally there will be a few cases of reinfection that can not be readily explained. On the whole this interesting study should be very gratifying, as the work has now been in progress long enough to answer satisfactorily the question of whether or not, if a herd is made free from bovine tuberculosis, it can remain free.

Area Work

Area work continues to be of great magnitude and importance. It is becoming popular in all sections of the country, and is working out in a very satisfactory manner in bringing about the desired results. Rapid progress has been made in many of the states. Altogether there are about 1,100 counties in the United States that have either completed the area testing or the work is in the process of completion. Counties in many of the states have supported this feature of the work splendidly. They have appropriated nearly $1,500,000 during this year to assist the state and

federal governments. On November 1, 1928, there were 598 counties in the United States where the degree of bovine tuberculosis infection had been reduced to not more than 0.5 of one per cent, and these counties were placed in the modified accredited area. This is a gain of 197 counties since November 1, last year. In one state, namely, North Carolina, all the counties are now in the modified status, while in other states a large percentage of the counties are also in the modified status.

The laws of nineteen states provide for area tuberculosis eradication work upon petition or by vote of the people, and it is hoped that the necessary legislation will be put into effect in other states so that the area plan may be conducted successfully in the future. In connection with this feature of the project it has been found that there is an economical and practical advantage in establishing area work in adjoining counties. This may be said of states as well.

The methods and rules governing area work provided by this association are working out very satisfactorily. Some changes may be required later to meet conditions that will arise, but I think that you will agree that, for a project involving so many complications, the plan laid out for us to follow is a practicable one. Area work is conducted under different methods in different states and, while it seems at times that some plans are better than others, on the whole satisfactory results are being obtained.

Within the next few years we will undoubtedly find that every county in several states will be placed in the modified accredited

TABLE I—*Annual results of tuberculin-testing of cattle in the United States under the Cooperative Tuberculosis Eradication Plan, 1917 to 1928*

Year	Cattle Tested	Reactors	
		Number	Per Cent
1917	20,101	645	3.2
1918	134,143	6,544	4.9
1919	329,878	13,528	4.1
1920	700,670	28,709	4.1
1921	1,366,358	53,768	3.9
1922	2,384,236	82,569	3.5
1923	3,460,849	113,844	3.3
1924	5,312,364	171,559	3.2
1925	7,000,028	214,491	3.1
1926	8,650,780	323,084	3.7
1927	9,700,176	285,361	2.9
1928	11,281,490	262,113	2.3
Totals	50,341,073	1,556,215	3.1

TABLE II.—*Record of tuberculin testing, cooperative tuberculosis eradication work, fiscal year 1928*

State	Herds Tested	Cattle Tested	Reactors Found	Per Cent Reactors	Infected Premises
Alabama	3,329	57,968	90	1.6	53
Arizona	5,145	49,914	539	1.1	271
Arkansas	2,663	17,065	47	0.3	32
California	3,153	108,757	1,120	1.0	389
Colorado	1,144	18,273	328	1.8	221
Connecticut	8,570	102,240	9,115	8.9	2,254
Delaware	2,304	23,963	1,402	5.8	455
District of Columbia	87	750	1	0.1	1
Florida	1,551	49,087	419	0.9	102
Georgia	7,681	50,932	314	0.6	117
Idaho	6,299	91,014	401	0.4	185
Illinois	102,095	978,198	17,055	1.7	8,318
Indiana	52,453	386,163	2,740	0.7	1,555
Iowa	63,545	981,315	22,425	2.3	9,216
Kansas	24,518	266,672	1,442	0.5	840
Kentucky	15,525	88,137	432	0.5	233
Louisiana	3,567	51,844	649	1.3	236
Maine	21,591	123,793	898	0.7	382
Maryland	15,262	152,451	8,654	5.7	2,710
Massachusetts	3,138	52,769	3,996	7.6	909
Michigan	61,599	547,921	9,578	1.7	5,148
Minnesota	67,044	1,244,963	26,254	2.1	11,861
Mississippi	6,181	38,282	144	0.4	24
Missouri	6,849	72,426	301	0.4	159
Montana	6,870	112,784	323	0.3	169
Nebraska	29,145	373,003	4,489	1.2	2,571
Nevada	821	17,290	155	0.9	78
New Hampshire	6,001	78,960	2,715	3.4	682
New Jersey	7,791	61,223	4,434	7.2	2,059
New Mexico	2,243	15,803	143	0.9	72
New York	72,426	839,089	53,414	6.4	12,782
North Carolina	26,323	91,249	217	0.2	166
North Dakota	14,644	236,219	2,212	0.9	1,125
Ohio	60,970	444,743	10,471	2.4	3,810
Oklahoma	447	17,444	86	0.5	31
Oregon	21,545	156,771	960	0.6	439
Pennsylvania	78,623	717,110	30,573	4.3	9,100
Rhode Island	474	9,138	1,311	14.3	274
South Carolina	21,355	62,016	95	0.2	66
South Dakota	6,620	127,716	1,708	1.3	858
Tennessee	14,367	89,491	186	0.2	109
Texas	2,176	29,772	719	2.4	400
Utah	14,419	89,453	758	0.8	642
Vermont	8,380	167,014	4,073	2.4	991
Virginia	15,950	93,197	788	0.8	385
Washington	20,213	184,904	9,433	5.1	1,859
West Virginia	17,070	74,197	414	0.6	257
Wisconsin	65,926	1,147,831	20,947	1.8	6,750
Wyoming	1,824	16,205	112	0.7	36
Hawaii	693	17,963	319	1.8	100
Alaska	81	798	19	2.4	2
Interstate	45,587	455,210	2,698	0.6	*
Totals	1,048,277	11,281,490	262,113	2.3	91,484

*Figures not available.
Note: Above table includes records of tuberculin-testing under area plan.

area. Sufficient retesting work has been done in modified accredited areas at the expiration of three years of modification to prove beyond any doubt that it is possible to maintain these counties comparatively free from bovine tuberculosis. One feature in this connection that I would like to mention is the importance of retesting modified accredited areas in time so that their modification will not expire. The present method requires remodification at the expiration of three years, and it has been found in practice that the retesting has been postponed too long in some instances, making it impossible for the county involved to qualify in time. With sufficient planning in advance this objection could no doubt be overcome.

The accompanying tables will serve to indicate what has been accomplished in tuberculin-testing work during the past eleven years; also the cooperative work done in each state and territory during the fiscal year ended June 30, 1928.

Reduction in Tuberculous Cattle and Swine

The records received from the Meat Inspection Division always attract a great deal of interest, as they relate to the number of cattle and swine found to be tuberculous, and it is through this service that we learn in another way whether headway is being made in reducing the amount of infection.

I am glad to report that during the fiscal year ended June 30, 1928, the retentions of cattle slaughtered in establishments under federal supervision were only one per cent, which is a reduction from 2.34 per cent, the high point reached in 1916. These figures do not include known reactors.

The records of swine indicate that tuberculosis was found in 12.1 per cent in 1928; while in 1924, the year in which the high point was reached, the percentage was 15.2. Two per cent of retained hogs were condemned or sterilized in 1928; while in 1924, 2.7 per cent of the retained hogs were either condemned or passed for sterilization. The following comparison will bring to your mind some losses that have been prevented as a result of the campaign to control and eradicate tuberculosis among live stock.

The number of cattle slaughtered in establishments under federal supervision during the fiscal years 1923 and 1928 was about 9,400,000, but there were 52,122 fewer cases of tuberculosis found among the cattle in 1928 than in 1923. The number of cattle carcasses condemned as unfit for food on account of tuber-

culosis was 17,622 less in 1928 than in 1923 (known reactors not included). A similar report of swine made during the same period shows there were 1,267,422 fewer cases of tuberculosis out of about the same number slaughtered, and there were 32,939 fewer hog carcasses condemned and 44,046 fewer carcasses passed for sterilization on account of tuberculosis. At prevailing prices the saving of these cattle and swine for food purposes represents a gain of over $3,000,000.

Appraisal Indemnity and Salvage

Reports for the last year indicate that the average salvage obtained for all reactors was about $40.00, which is greater than in any other period, except one, in the history of the campaign. The question of marketing reactors and obtaining the maximum salvage for them has received continued attention. Careful study and exercise of the proper management of this phase of the work are of great importance. Monthly reports of the appraisal, indemnity and salvage; also a special report of the net salvage received for reactors slaughtered at the various marketing-points throughout the country, are issued by the Department, which serves to furnish the various state officials data from which they can make comparisons of prices. There are three states in which no indemnity for tuberculous cattle is paid at the present time.

Tuberculin Testing

Careful study of the results of tuberculin-testing is made at all times, and whenever it appears that the results are not as they should be, an investigation is made at once. It has been found that careful technic in applying the tuberculin test is of major importance. The operator must at all times exercise the greatest care and judgment in determining whether or not the animal tested is a reactor to his tuberculin test, and in this connection combination tests have been found of great value and aid.

In some months the percentage of no-visible-lesion cases found among reactors to the tuberculin test has been higher than in others, and it has not always been possible to explain this condition. But, generally speaking, it may be said that we have found a higher percentage of no-macroscopic-lesion cases when the work was conducted in areas where retesting was being done. This is to be expected and should serve as an encouraging factor in that it shows disease elimination. With the skillful application of the tuberculin test by the veterinarians in the field, we should feel confident that the disease can be permanently placed under

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control and eventually eradicated from any given herd of cattle or from an area, provided, of course, the necessary sanitary requirements are complied with.

Cattle Tested for Interstate Shipment

Under the provisions of the federal regulations, cattle intended for dairy or breeding purposes must be tuberculin-tested before being moved interstate. Such a regulation has been in effect since July 1, 1919. The proper conduct of this branch of the project of eradicating tuberculosis is also a very important factor, and a very large one at times.

During the last fiscal year, 445,000 cattle were tuberculin-tested for interstate shipment. (All but about 50,000 of these were tested by practicing veterinarians.) This is the greatest number of dairy and breeding cattle that have ever been tuberculin-tested for interstate shipment in any previous year. As an indication of how this branch of the work has grown, I will mention that in 1921, or seven years ago, the number of cattle tested for interstate shipment was approximately 279,000. About 27,000 reactors were removed from lots of cattle that were intended for interstate shipment during the past eight years, thereby preventing the spread of the disease to a considerable extent. This work is being conducted in a very satisfactory manner at this time, and I wish to urge all veterinarians who are interested in this important branch of the work to use the greatest care in the performance of their duties in order to prevent the spread of tuberculosis.

Paratuberculosis

A limited amount of work has been done in a few states in investigating Johne's disease. Reactors to this disease have been removed and slaughtered and state and federal indemnity paid for 224 cattle condemned. From present indications considerable more research work, both in the laboratory and in the field, will have to be done before it will be possible to proceed to any great extent with the control and eradication of this disease.

Avian Tuberculosis

This important subject has received more attention during the past twelve months than heretofore and, while it is yet too early in the campaign to report any definite results in the control and eradication of this disease, there are indications that material progress has been made. There has been a reduction in the

number of hogs retained for tuberculosis at the packing-centers, and in numerous localities where poultry is raised there is evidence that the owners are trying to stamp out the infection, and are taking necessary steps to prevent its introduction and spread.

The educational work required to make it possible for the poultry-raisers in the infected sections of the country to realize the seriousness of this menace and how it may be combated has been continued by the various state, county and federal officials connected with the cooperative tuberculosis eradication work. The live stock commissioners of the various live stock exchanges, working under the direction of Prof. H. R. Smith, of Chicago, have contributed much to the cause by their efforts in getting helpful information to the farmer who raises poultry. It would seem, and it is hoped, that with the aid of the valuable research work that is being carried on in various parts of the country, more progress in the control and eradication of this disease will surely be made in future years. Avian tuberculosis at the present time exists to but a slight degree, except in the middle western states.

Personnel

During the past year approximately 965 veterinarians have devoted their full time to tuberculosis eradication work; 258 of them were employed by counties; 397 by states and 210 by the federal government. A large number of tuberculin tests also were made by practicing veterinarians at the owners' expense. These men also tested many cattle when employed temporarily by the state or county. A larger number of veterinarians were engaged in this work during the past year than in any previous year, making it possible to make greater progress than in any similar period.

Conclusion

That we have made marked headway in the campaign during the past twelve months cannot be denied and this fact is evidenced, particularly, by the growth of the modified accredited area. The results obtained by retesting cattle in modified accredited areas after the expiration of three years, and the annual retesting of infected herds, show the importance of eliminating the danger of exposure to infection; and it also shows that it is possible to maintain herds of cattle and areas free from tuberculosis by so doing.

Substantial progress in eliminating tuberculosis from our live stock can be made each year. I am sure that it can be done by keeping up the excellent spirit of cooperation that now prevails and by continuing efficient practices in all branches of the campaign.

Since our last meeting we have experienced an irreparable loss in the death of two of our most distinguished leaders and coworkers, the late Dr. John A. Kiernan and Dr. Ernest C. Schroeder. The contributions of these two eminent veterinarians have had more to do with establishing the work of tuberculosis eradication on a firm foundation than we can ever realize, and the good work which they accomplished will serve as an inspiration to those of us who are left to do our best to complete successfully the great and worthy task that confronts us.

PRESIDENT CARY: Gentlemen, we have another paper that we want to get off before lunch, one that we all want to hear, one of the most important papers that we shall hear during this meeting. Dr. D. C. Lochead, Deputy Health Commissioner of Rochester, Minnesota, will talk to us on "Transmissibility of Bovine Tuberculosis to the Human." (Applause.)

DR. LOCHEAD: The President said that a lot of you would not be back this afternoon so he wanted to put the paper on the program this morning. I want to emphasize one or two points. I do not claim to be an authority on the subject of bovine tuberculosis in humans, that is, from my own experience or investigation. I am reporting to you the investigations of others as I have found them in my reading and study. I am not a member of the Mayo Clinic. I want that understood very definitely, because some of the antis have been making capital out of that point. I am a personal employe of Dr. C. H. Mayo. I am endeavoring to present Dr. Mayo's opinions to you. I will say that I am going a little further than if I were presenting my own opinions. He is enthusiastic to the nth degree in tuberculin testing and tuberculosis eradication matters in vogue in this country.

. . . Dr. Lochead read his paper. . . . (Prolonged applause)

TRANSMISSIBILITY OF BOVINE TUBERCULOSIS TO THE HUMAN

By. D. C. LOCHEAD, *Rochester, Minnesota*

Deputy Health Officer

Tuberculosis of man and beast is an age-old disease, its beginnings are buried in antiquity; and it has come down to us through the centuries as consumption. Not many years ago, it was popularly called "Captain of the Men of Death," because it caused the death of more persons than any other one disease. During the past twenty years the human death-rate from tuberculosis has been more than cut in half, and its occurrence has been considerably lessened; and today there are several disease conditions

causing more deaths than tuberculosis, which still, however, numbers nearly 100,000 among its victims annually in this country. How many people there are who have tuberculosis it is impossible to say, because often it cannot be diagnosed and frequently it is not reported to health departments by physicians until death occurs. Dr. T. B. Magath, of the Mayo Clinic staff, has estimated that 20 per cent of those having tuberculosis die of it, which would mean that there are half a million people in the United States suffering from tuberculosis. It is a well-known fact that many people receive infection with the tubercle bacilli who never suffer from tuberculosis and it has been estimated that 75 per cent of all of us at some time or other during our lives, receive sufficient infection that signs of it can be found on examination after death, even though we have not suffered from the disease sufficiently for it to be determined during life.

The discovery by Koch, in 1882, of the germ organism which is always the cause of tuberculosis—the tubercle bacillus—enabled us to study the disease systematically and helped us to recognize it when it occurred and to determine the ways in which it spread from one to another. Then, because of the fact that cattle suffered from disease in which the tubercle bacillus was found and because the tubercle bacillus was found in the milk which humans consumed, it was thought by many that much of human tuberculosis was transmitted to them from cows through their milk. Enthusiastic proponents of this theory doubtless exaggerated the frequency of its occurrence. Then students of the problem, notably Dr. Theobald Smith, found that the tubercle bacillus obtained from lesions in cattle was not just exactly the same as the tubercle bacillus obtained from human lesions. He found that apparently there were certain morphologic, cultural and pathologic differences and that different results occurred when the respective cultures were injected into other animals; and that is the way today we determine whether the tubercle bacillus, in a given case, is the human, bovine, or avian type and so decide where the infection came from.

Generally speaking, most authorities have accepted Theobald Smith's classification of types and a lot of evidence seems to prove that when transmitted to another animal the infection always holds true to type. However, some qualified scientists and physicians are still doubtful. Such an authority as Adami, of Montreal, favors the opinion that the bovine bacilli may, on account of long residence in the human body, take on the

characteristics of the human type. This is also accepted as a possibility by von Behring and Calmette; and Dr. C. H. Mayo has said:

> The slight difference in type or form between the bacillus of tuberculosis of man and that of animals has led to much dispute. By gradually varying culture medium, much higher or lower degrees of virulence may be produced in most germs. Direct attempts to inoculate different kinds of domestic animals may apparently fail, yet it is known that cattle rapidly infect each other; healthy hogs in the same yard with infected cattle become infected as do the poultry, a sufficient number of bacilli in varying forms existing in barn-yard manure.
>
> While various observers have found slight difference in size and shape of the bacilli in the human, bovine and avian forms of tuberculosis and difference in time of staining, they are so slight that they represent far less variation than those found in streptococci by Rosenow who was able to show transmutability among *Streptococcus viridans*, *Streptococcus hemolyticus* and the pneumococcus under varying degrees of oxygen tension of the culture medium.
>
> Considering all the evidence we must believe that the bacilli of these three types are but variations of one species of organism and not different entities.

Which brings us to the question: Is not the tubercle bacillus, which is slightly different in different species of animals, really the same organism which has acquired these different characteristics by living for generations in the slightly different animal? And is not the possibility of infecting other animals a question of difference in the animals? And may not the possibility of disease transmission increase with repeated doses of infection?

In 1901, Koch went to the other extreme when he stated, at the London Congress on Tuberculosis, that the germs were not the same and that there was practically no danger of man contracting tuberculosis from cattle or about as much as there was danger to man from an inheritance of the disease, which of course means none at all, and he said that he did not deem it advisable to take any measures against its spreading from cattle to humans.

Koch's views were immediately studied by many scientific workers, individually and collectively, all over the world. The German Government authorized an investigation and the British Government appointed a Royal Commission. The Pennsylvania State Live Stock Sanitary Board, the New York City Health Department and the officials of the U. S. Bureau of Animal Industry also carried on investigations. As a result, Koch's opinion as to the transmission of bovine tuberculosis to man has been fully disproved. But Koch's position in the scientific world was most outstanding. His opinions carried great weight and his words had a great influence on public opinion and they still have, and Koch's statements are the foundation

today for a few scientists, some doctors and many lay people who feel that we are exaggerating the menace of bovine tuberculosis to humans.

As different scientists presented evidence and opinions contrary to Koch's, he came to modify his opinions, but he continued to his death to minimize the menace of bovine tuberculosis to humans. At the Sixth International Congress on Tuberculosis, at Washington, in 1908, when faced with almost unanimously contrary reports and opinions from other scientists, he opened the discussion on the relation of human and bovine tuberculosis by saying that "human beings may be infected by bovine tubercle bacilli but serious diseases from this cause occur very rarely and preventive measures against tuberculosis should therefore be directed, primarily, against the propagation of human tubercle bacilli."

In contradiction of Koch's opinions the following spoke: Professor G. Sims Woodhead, Cambridge, England; Johannes Fibiger, of Copenhagen; M. P. Ravenel, of Madison, Wisconsin; Prof. Chas. W. Duval, Tulane University, New Orleans; Dr. Chas. F. Dawson, Newark, Delaware, and others. Koch finally declared that he had never denied that bovine tuberculosis is found in man and tried to narrow the discussion to a consideration of bovine tuberculosis in the lungs of humans. He asked whether "any case of pulmonary tuberculosis exists in which tubercle bacilli of the bovine type were found, not once but repeatedly." When Professor S. Arloing, of Lyons, France, Prof. G. Sims Woodhead of Cambridge, England and Prof. Fibiger, of Copenhagen, mentioned such cases, Koch questioned the accuracy of their investigations and reports and finally concluded by saying:

> I admit that bovine infection can occasionally occur, and I desire not to be understood as disregarding the endeavors to extirpate bovine tuberculosis, as far as these endeavors are dictated by agricultural and economic reasons. But I mean that it would be wrong to give to those proposals the leading place in front of the efforts to combat human tuberculosis.

Quite a modification of his position in London, in 1901, when he said:

> I should estimate the extent of the infection by milk and by flesh of tuberculous cattle, and the butter made of this milk, as hardly greater than that of hereditary transmission, and I therefore do not deem it advisable to take any measures against it.

Koch's opinion as to the transmission of bovine tuberculosis to man was conclusively disproved by the final report of the

British Royal Commission, presented after nine years of study and investigation, where it said:

> We have investigated many instances of fatal tuberculosis in the human subject in which the disease was undoubtedly caused by a bacillus of the bovine type and by nothing else. . . . Man must therefore be added to the list of animals notably susceptible to bovine tubercle bacilli.

Some of the Commission's results are found in table I, compiled from "Royal Commission Reports and Papers," published by Eastwood and F. and A. S. Griffith.

TABLE I.—*Results of investigations by British Royal Commission*

Varieties	Number of Cases	Percentage of Cases Infected with Bovine Bacilli	
		Under Five Years	All Ages
Cervical glands	125	85.0% of 20 cases	48.0%
Lupus	140	66.0% of 50 cases	51.0%
Scrofuloderma	52	58.3% of 12 cases	38.4%
Bone and joint	514	30.2% of 96 cases	19.2%
Genito-urinary	21		19.0%
Meningeal	12		16.6%
Pulmonary	275		1.1%
Postmortem cases, children under twelve	113	21.3% of 61 cases	(all ages 17.6% under 12)

TABLE II.—*Cases in children under twelve, classified according to anatomical distribution of the primary lesion, showing percentage of bovine infections*

Varieties	Cases	%
Alimentary	35	80.0
Respiratory, double portal (respiratory and alimentary) and uncertain	116	1.8

(From Fifth Conference of the International Union Against Tuberculosis—"The Relation of Milk to Tuberculosis," by W. H. Park.)

In view of such a report which was practically duplicated almost unanimously by research workers in Germany, France, Denmark, the United States and other parts of the world, one would think the question of the menace of bovine tuberculosis to humans was settled nearly twenty years ago. But so great was Koch in the world of tuberculosis research and study that some of his followers continued to carry on the fight in support of his opinions and to this day opponents of the fight to eradicate bovine tuberculosis quote Koch's old arguments in spite of the fact that they have been so many times conclusively disproven. Unfortunately some of the laymen who are personally interested, or having committed themselves in exaggerated statements like

Koch's, continue to defend them to the last, discounting all evidence which would disprove their contentions.

It is of course advisable to endeavor to find out how frequently bovine tuberculosis occurs in humans. After studying reports and statistics from all parts of the civilized world, I am satisfied a conservative estimate of the danger of bovine tuberculosis to humans would be that 25 per cent of tuberculosis in children and 5 per cent of all tuberculosis in humans is due to infection with the bovine germs, which, in the majority of instances, were received through the consumption of tuberculous milk. Bovine

TABLE III.—*Results of investigations by Park and Krumwiede*

Diagnosis of Cases Examined	Adults Sixteen Years and Over		Children Five to Sixteen Years		Children Under Five Years	
	Human	Bovine	Human	Bovine	Human	Bovine
Pulmonary tuberculosis	278		8		5	
Tuberculous adenitis (inguinal and axillary)	1		4			
Tuberculous adenitis (cervical)	9		19	8	6	12
Abdominal tuberculosis	1		1	1		3
Generalized tuberculosis (alimentary origin)					1	1
Generalized tuberculosis	2		1		12	4
Generalized tuberculosis, including meninges					18	1
Tuberculous meningitis			1		14	1
Tuberculosis of bones and joints	1		10		6	
Genito-urinary tuberculosis	3	1	1			
Tuberculous abscesses	1					
Totals	296	1	45	9	62	22

(From Fifth Conference of the International Union Against Tuberculosis, "The Relation of Milk to Tuberculosis," by W. H. Park.)

tuberculosis sometimes causes lung tuberculosis in humans, but usually it causes the other forms, such as in the bones and joints, glands in the neck, chest, abdomen, the membrances of the brain and spinal cord and generalized miliary tuberculosis.

These figures and estimates will of course vary in different localities, states and countries, depending first on the amount of tuberculosis in the cattle originally and on the amount of effort being made to eradicate it by tuberculin-testing, and secondly on their protection through pasteurizing milk. It will be lower in the South and higher in the East and much higher in European countries, especially in England and Scotland, where

very little tuberculin-testing has been done and where very little of the milk is pasteurized.

In 1910, Park and Krumwiede, of New York, made an extensive series of tests in New York City on persons of every age and on every kind of case. The results are shown in table III.

This shows that 7.3 per cent of all 435 cases were of bovine origin and that in children under 16 years, 22 per cent of 138 cases were bovine and under 5 years, 26 per cent of 84.

In 1911, Park and Krumwiede collected a total of 1224 observations made in different countries and in which were given the bovine or human type of the infection and the age of the subjects. (See table IV.)

TABLE IV.—*Data collected by Park and Krumwiede*

Diagnosis	Adults of More Than 16 Years		Children from 5 to 16 Years		Children Younger Than 5 Years	
	Human	Bovine	Human	Bovine	Human	Bovine
Pulmonary tuberculosis...	644	1	11		23	1
Glandular tuberculosis (axillary or inguinal)......	2		4		2	
Cervical gland tuberculosis	27	1	36	21	15	21
Abdominal tuberculosis...	14	4	8	7	9	13
Generalized tuberculosis (alimentary origin).....	6	1	2	3	13	12
Generalized tuberculosis (with meningitis, alimentary origin)........	29		5	1	46	13
Generalized tuberculosis (with meningitis)......	5		7		52	1
Tuberculous meningitis...	1		3		27	4
Bone and joint tuberculosis	27	1	38	3	26	
Genito-urinary tuberculosis..................	17	1	2			
Cutaneous tuberculosis...	3		1		1	
Other tuberculoses: of the tonsils...............				1		
of the mouth and glands of the neck..........		1				
of the maxillary sinus..	2					
Latent tuberculosis......					1	
	777	10	117	36	215	65

Mixed infections (bovine and human): 4 cases. Total: 1224 cases.

The percentage of cases of bovine infection, mixed infections excluded, is shown in table V.

This shows that over 9 per cent of all 1220 cases were of bovine origin and that in children under 16 years over 23 percent of 433 cases were bovine, as were 23 per cent of 280 under 5 years.

TABLE V.—*Percentage of cases of bovine infection, mixed infections excluded*

	ADULTS OF 16 YEARS AND OVER	CHILDREN FROM 5 TO 16 YEARS	CHILDREN UNDER 5 YEARS
Pulmonary tuberculosis...	0	0	4.1
Glandular tuberculosis....	3.6	36.0	58.0
Abdominal tuberculosis...	22.0	46.0	59.0
Generalized tuberculosis..	2.7	40.0	23.0
Tuberculous meningitis...	0	0	13.6
Bone and joint tuberculosis	3.5	7.3	0

(From: "Tubercle Bacillus Infection and Tuberculosis in Man and Animals," by Calmette.)

TABLE VI.—*Fatal cases, baby hospitals*

DIAGNOSIS	CHILDREN 5 TO 16 YEARS		CHILDREN UNDER 5 YEARS	
	HUMAN	BOVINE	HUMAN	BOVINE
Pulmonary tuberculosis..............			4	
Generalized tuberculosis.............	1		9	2
Generalized tuberculosis, including meningitis.........................			15	1
Tuberculous meningitis..............			11	1
Totals.........................	1		39	4

Total under 5 years: 43, of which 4 (9%) were due to the bovine type.
(From Fifth Conference of the International Union Against Tuberculosis. "The Relation of Milk to Tuberculosis," by W. H. Park.)

TABLE VII.—*Combined table of all cases*

	ADULTS 16 YRS. OR OVER		CHILDREN 5 TO 16 YEARS		CHILDREN UNDER 5 YRS.		UNDER 16 YRS. %	ALL AGES %
	H.	B.	H.	B.	H.	B.	BOVINE	BOVINE
Pulmonary tuberculosis including sputum.........	1,000	5	28		45	1	1.3	0.5
Abdominal tuberculosis.....	24	7	13	17	29	34	55	47
Generalized tuberculosis.....	39	2	32	3	169	22	11	10
Genito-urinary.............	35	4	4				0	9.3
Tuberculous meningitis.....	6		13	5	55	10	18	16.8
Tuberculous skin...........	12	3	4	6	2		50	33.3
Tuberculous cervical adenitis	62	10	61	76	18	75	66	53
Tuberculous axillary adenitis	6		8		4		0	0
Tuberculous bone and joint..	82	4	255	61	89	54	25	21
Latent tuberculosis.........	2	1	2	2	4	1	33.3	33.3
Miscellaneous (other forms).	5	2		1		2	100	50
	1,273	38	420	171	415	199		
Percentage of bovine infection at each age period....	2.9		28.9		32.4			

Total in 2,516 of 16 per cent bovine type.
Non-pulmonary, all ages, 1437 cases=28 per cent bovine.

In order to indicate the extent of infant infection, Park gives the data shown in table VI.

A table (VII) of all cases reported in the literature up to 1914 was given by Wang, in the *Journal of Pathology and Bacteriology* (1916).

This probably gives the most accurate estimate of the amount of bovine infection existing at that time in Western Europe, the British Isles and the United States.

During the years of the war few if any bacteriological examinations were made for the type of tubercle bacilli in human cases. Since then the majority of reports have come from Great Britain and show that the percentage of bovine infection remains high.

Park, of New York, in his excellent paper (which I recommend you all to read) "The Relation of Milk to Tuberculosis," read before the Fifth Conference of the International Union against Tuberculosis, in Washington, in 1926, quoted an interesting report given by Cobbett, of Cambridge, in 1922, on the post-war percentage of bovine infection (table VIII).

Present knowledge on this subject was summarized by Dr. A. Stanley Griffith, in his paper read before the National Milk Conference (London, 1922). In the course of his remarks he gave details in regard to 1,215 English and Scottish cases, in which the type of tubercle bacillus had been determined by

TABLE VIII.—*Proportion of bovine infection in various kinds of human tuberculosis at all ages in England and Wales*

METHOD OF INFECTION	VARIETIES OF TUBERCULOSIS	TYPES OF TUBERCLE BACILLI (%)	
		HUMAN	BOVINE
Group I—Aerial infection	Pulmonary	98.7	1.3*
	Bronchial glands	94.5	5.5
Group II—Food	Intestinal, peritoneal mesenteric, gland	50	50
	Cervical gland	54	46†
Group III—Various degrees of dissemination from either aerial or food infection	General tuberculosis	84	16
	Meningitis	82	18
	Bones and joints	80	20‡
	Genito-urinary	82	18
Group IV—Skin infection	Lupus	50	50

*If we take the figures available for the whole world, the percentage of bovine infection in pulmonary tuberculosis is only 0.4.

†Mitchell gives 90 per cent for Scottish cases, Griffith 71.4 per cent for similar cases.

‡Fraser gives 58.6 per cent for Scottish cases, Griffith 29.6 per cent for similar cases, and in U. S. A. the percentage is 21.6.

identical methods employed for demonstrating the differential characteristics of the infecting tubercle bacilli. He showed that, of the total number, 935 (77 per cent) were of human origin and 280 (23 per cent) were of bovine origin. Dr. Griffith showed separate tables in respect to different varieties of human tuberculosis, from which I have prepared table IX:

TABLE IX.—*Proportion of bovine to human infection in the different varieties of human tuberculosis, compiled from tables given by A. Stanley Griffith, at the National Milk Conference (London, 1922)*

	Number of Cases	Human	Bovine	Percentage Bovine
Cervical gland tuberculosis	116	62	54	46.5
Bone and joint tuberculosis				
(a) England and Wales	476	389	87	18.3
(b) Scotland	28	20	8	28.6
Lupus	126	62	64	50.8
Scrofuloderma	52	32	20	38.4
Genito-urinary tuberculosis	17	14	3	17.6
Examination of postmortem material from children:				
(a) Local government board series	113	93	20	17.7
(b) Royal Commission series	46	27	19	41.3
Tuberculous meningitis	12	10	2	16.6
Pulmonary tuberculosis	229	226	3	1.31
Totals	1215	935	280	23.05

It is estimated by Cobbett, from the above data, that the bovine type of bacillus causes about 6.44 per cent of the total deaths from tuberculosis of all kinds in England and Wales, or approximately 3,000 deaths every year.

In addition to the estimated 3,000 who die, the number of people who do not die but who suffer for a long period, perhaps throughout life, from tuberculosis as a result of drinking infected milk, is very much higher.

In the *Veterinary Journal* (London, 1925), page 167, in a paper on "The Danger of Tuberculous Milk," Dr. Griffith said:

> I have continued my investigations of the subject, and during the years 1922-23-24, I have examined material from forty-five persons suffering, except in four instances, from surgical forms of tuberculosis.
>
> The majority of these cases were under the care of Sir Henry Gauvain, to whom I am greatly indebted for his cooperation in my inquiries.
>
> In the following table (X) the results of the investigation of these forty-five cases are summarized.
>
> The figures also show that 50 per cent of the lupus cases and 40 per cent of the bone and joint cases were of bovine origin. It will be seen that the latter percentage is higher than in the series of bone and joint cases in the previous table.

TABLE X.—*Results of investigations conducted by Griffith.**

Variety of T. B.	Number of Cases	Under 15 Years of Age		Over 15 Years of Age	
		Human	Bovine	Human	Bovine
Lupus and scrofuloderma	22	11	11		
Bone and joint	13	6	4	3	
Cervical gland	4		1	3	
General	2	1	1		
Meningeal	2	2			
Kidney and testis	2			2	
	45	20	17	8	

More recently Dr. Griffith read a paper entitled, "Tuberculosis of Bovine Origin in the Human Subject," at the Eleventh National Conference on Maternity and Infant Welfare, held in London, July 5-7, 1927. It deals with 541 cases of bone and joint tuberculosis, with the result that 18.7 per cent of them were found to be caused by tubercle bacilli of the bovine type. This percentage refers to patients of all ages; if one takes only children under five years of age (102 cases), the percentage so infected naturally rises and here it is 30 per cent. Under ten years (327 cases) it is 25 per cent.

In Minnesota, in 16 years, from 1910 to 1925, there were 34,570 people who died of tuberculosis and 6,343 of those died of other forms than lung tuberculosis (18%). On a basis of 5 per cent of the total, this would mean that 108 people died here every year of bovine tuberculosis. It has been estimated that 0.5 per cent of lung tuberculosis and 10 per cent of other forms of tuberculosis in humans is caused by the cattle germ. Figuring on that basis then, 48 people died here every year of bovine tuberculosis. If we accept this lowest estimate of 48 annual deaths, in addition to the hundreds of cases of bovine infection which does not kill, but results in crippling and incapacitating for a long period or the rest of life, I am sure we are justified in all our efforts to eradicate bovine tuberculosis.

One might go on indefinitely quoting statistics from recognized authorities. Today no recognized authorities and few physicians doubt the transmissibility of bovine tuberculosis to humans, but there are still some who minimize the danger, even to the extent of opposing the efforts of those who are endeavoring to eradicate the disease from cattle, on the ground that the menace is so slight

*These figures show that in all ages 37 per cent were bovine and under fifteen years 45 per cent were bovine.

as not to constitute a public health problem. I am satisfied that the figures I have quoted prove conclusively that the danger of bovine tuberculosis to man is quite sufficient to justify all the efforts and all the expenditure to eradicate the disease from cattle and to justify me in saying that all milk used must be from cows negative to the tuberculin test, whether the milk is to be pasteurized or not.

I say this in spite of the fact that bovine tuberculosis is not so prevalent, either among cattle or humans, in this country as it is in European countries, especially England and Scotland, and I am convinced of the fact that investigation today would show a considerably reduced percentage of bovine tuberculosis among humans in this country than when such investigations were last made some years ago.

It could not be otherwise, in view of the fact that so much has been done to reduce it, so much of our milk has been pasteurized for so many years and also because there have been so much tuberculin-testing and slaughter of reactors. We have paid for these procedures and we are reaping the reward as shown by what figures are available.

In a previous paper (Omaha, 1926) I said that in 1907 there were 70 operations for tuberculous glands of the neck at the Mayo Clinic (1.2 per cent of all operations) and in 1924 there were only 66 such operations, or .28 per cent of all operations. In other words, there were fewer operations for tuberculous glands of the neck in 1924 than there were in 1907, when there were not one-fourth as many operations.

Table XI is a comparative table of cases of tuberculosis other than pulmonary, diagnosed at the Mayo Clinic in 1917 and 1927,

TABLE XI.—*Cases of tuberculosis other than pulmonary diagnosed at the Mayo clinic*

	1917	1927
Tuberculosis, all other forms than pulmonary	718	746
Tuberculosis of meninges and nervous system	6	5
Tuberculosis of intestines and peritoneum	62	61
Tuberculosis of vertebral column	109	118
Tuberculosis of hip joint	47	51
Tuberculosis of joints	130	158
Tuberculosis of bones	14	24
Tuberculosis of skin	4	6
Tuberculosis of cervical glands	139	115
Tuberculosis of lymphatic glands	44	48
Tuberculosis of genito-urinary system	163	160

when there was an increase of over 50 per cent in the number of patients, and shows a marked relative decrease of the forms of tuberculosis among which we find the bovine type.

In Minnesota recently, in eight years (1914-1922), the death-rate from tuberculosis was reduced from 107.5 per 100,000 to 69.6, the lung tuberculosis rate from 86.7 to 59.4, while other forms, which include practically all of the bovine cases, from 20.8 to 10.2. That is, the pulmonary rate was reduced 31 per cent, while the rate from other forms was reduced 50 per cent, which means that the reduction where the bovine cases are found was much greater than among cases of the human type.

Park said in his paper, "The Relation of Milk to Tuberculosis," previously referred to:

> Let us look at some results of tests for the type of tubercle bacilli in human cases of tuberculosis investigated before and after the pasteurization of milk was adopted.
>
> PERCENTAGE OF BOVINE AND HUMAN TYPES OF TUBERCLE BACILLI IN TUBERCULAR CERVICAL LYMPH-NODES AND IN MENINGITIS IN NEW YORK CITY BEFORE AND AFTER THE ADOPTION OF GENERAL PASTEURIZATION OF THE MILK SUPPLY
>
> 1. Before the general pasteurization of milk but after the adoption of the general use of heated milk for infant feeding with the exception of certified milk.
>   Tuberculous meningitis............54 Human 3 Bovine— 5.3%
>   Tuberculous adenitis (cervical).....34 Human 21 Bovine—38 %
> 2. After pasteurization of the general milk supply but with still the exception of certified milk. This protected raw milk amounted to about 1.5% of the whole supply.
>   Tuberculous meningitis............48 Human 3 Bovine— 5.8%*
>   Tuberculous adenitis (cervical).....30 Human 6 Bovine—16 %†
>
> From such findings in New York, Paris and Boston, there can be no question that the heating of cow's milk and its products is an efficient means of greatly lessening the incidence of bovine infection in man. Not only milk but other milk products such as butter and cheese should be pasteurized.

Opponents to present-day methods of eradication in this country, by area tuberculin-testing and slaughter of reactors, have used many arguments mostly as antiquated as Koch's London statement, some even older; and some based on objections to the old subcutaneous test as grounds for their objections and opposition to present-day methods. I have tried in the papers I have been privileged to present to several of the district tuberculosis conferences and at your conference last year to answer

*There was a history in the case of one of the three, a child two years old, of having been fed on pasteurized milk. In the other two no clear history could be obtained.

†Two cases onset of disease in pre-pasteurization days.
Two cases Grade A raw milk and certified raw milk.
One case fed on ordinary raw milk.
One case, seven years of age, according to history, was never given cow's milk. Butter might have been the source.

or explain some of the claims of those opposing eradication methods.

One of these arguments that persists is that it is only through drinking milk from cows with obvious udder lesions that tuberculosis is transmitted from cows to humans. That is not correct and in my opinion obvious udder lesions are not the usual source of tubercle bacilli in milk, as only a small percentage of tuberculous cows have obvious udder lesions.

Bovine tubercle bacilli of course occur in milk directly as a result of tuberculosis of the udder which, it has been stated, occurs in 1 to 3 out of every 1,000 cows. Chesley, of Minnesota, reports:

> In 1200 autopsies of reactors, udder tuberculosis was found in 5.75 per cent. In generalized tuberculosis the udder has been found to be affected in about 17 per cent. Frequently cases of generalized tuberculosis show no clinical symptoms of udder involvement.

Of course there may be udder lesions which are not obvious during life or even on careful postmortem examination, they may be of microscopic size and may not be obvious then even when present. But it is not necessary even to have microscopic lesions in the udder for the tubercle bacilli to be excreted with the milk. During milking the udder is essentially an eliminating structure and even though it is not involved locally, tubercle bacilli may pass out in the milk, just as tubercle bacilli are passed from healthy kidneys when the tuberculosis is elsewhere in the body. If the udder is tuberculous, of course, many more bacilli will be found in the milk. Milk from a tuberculous udder may contain as many tubercle bacilli as are ordinarily found in sputum from tuberculous lungs. The milk from one tuberculous udder may contain sufficient bacilli to infect seriously the milk of 25 to 30 cows.

But tubercle bacilli may occur in milk indirectly, through cow manure. In lung tuberculosis tubercle bacilli are coughed up, swallowed and passed in the manure. The manure gets into the milk in many ways with which we are all familiar, carrying its tubercle bacilli with it.

Furthermore, it is not necessary for the cow to have lung tuberculosis in order that the tubercle bacilli may be present in the manure. Nor is it necessary for the cow to have intestinal tuberculosis.

Keller and Moravek read a paper before the Medical Association of Greater New York, published in the November 20, 1915, issue of the *Medical Record*, in which they report experiments

of inoculating guinea pigs with suspensions of tubercle bacilli into joints and subcutaneously and, by the eighth day, recovering acid-fast bacilli from their feces with no presence of intestinal lesions and on injecting cultures from the feces into guinea pigs the pigs developed tuberculosis. They concluded that no matter how the bacillus is introduced into the system, it will make its appearance in the feces without producing a pathological lesion in the intestinal mucous membrane.

So that if there is tuberculosis present in any part of the cow it may be excreted in the milk or be present in the manure.

The possibility of the presence of tubercle bacilli in milk is not only theoretical, it is of practical importance. It does occur. How often or how much varies in estimation with different investigators in different cities, states and countries. The literature contains many reports.

Park, in the paper to which I have previously referred, said:

> Early investigations in Europe and America showed that from 6 to 15 per cent of the samples of market milk were infected. Brittlebank, Chief Veterinary Officer of Manchester, gives a series of figures covering twenty-three years (1901-1923) which show 9.88% mixed milk samples were found to contain tubercle bacilli and unfortunately the number sending infected milk in 1923 is greater than in 1901.
>
> In 1924 Somer examined 353 samples of Birmingham milk. Twenty-nine of the samples infected guinea pigs with tuberculosis. On the farms producing this milk he found 97 suspicious cows. The milk from 31 of these proved to be infected. During the same year, in Edinburgh, 8.1% of 403 samples were positive. We are now testing 200 samples of the New York City supply, but it is too early to state the outcome. The results of tests in other countries of Europe and America indicate that the cattle are everywhere infected, but in different degrees of from 5 to 30 per cent.

The late lamented Dr. E. C. Schroeder presented a paper on "The Occurrence and Significance of Tubercle Bacilli in the Feces of Tuberculous Cattle," at the Sixth International Congress on Tuberculosis, at Washington, in 1907, in which he said:

> Tests made at the experiment station of the U. S. Bureau of Animal Industry demonstrated that many seemingly healthy tuberculous cattle expel virulent tubercle bacilli from their bodies per rectum with their feces.
>
> Twelve tuberculous cows were collected from several dairy herds and kept under observation for about two years. They were in excellent general condition and had no visible symptoms of disease; they were not known or suspected to be tuberculous until they were tested with tuberculin.
>
> During the first two months 5, or 41⅔ per cent, of the cows were intermittently expelling acid-fast bacilli per rectum; eighteen months later the number had increased to 10, or 83⅓ per cent; that is, it has doubled, though the majority of the cows still retained their apparently good condition and showed no symptoms of tuberculosis.
>
> The various facts presented (as a result of the tests made) clearly seem to justify the following conclusions:

1. Tuberculous cows, wholly free from visible symptoms of tuberculosis, frequently expel tubercle bacilli from their bodies per rectum.

2. Tubercle bacilli in the feces of tuberculous cows are not dependent upon intestinal tuberculosis, but commonly have their origin in the lung.

3. Since the feces of cattle are a common, almost universal, impurity in milk, the presence of tubercle bacilli in the feces of tuberculous cows makes it practically impossible to obtain milk at all times free from tubercle bacilli either from tuberculous cows or in the environment of tuberculous cattle.

Now, let us bear in mind that from 15 to 30 per cent of our dairy cows are affected with tuberculosis; that the examination of over 300 samples of milk from the local market showed that 5½ per cent, or 1 in 18, contained virulent tubercle bacilli. And it will become evident that the tuberculous cow is, by herself, a sufficient source of virulent tubercle bacilli to account for the infection of the whole human race.

In our fight against tuberculosis we must consider all the sources from which tubercle bacilli are disseminated, and though I do not wish to give the impression that I believe the bovine source to be of more importance than the human, I am thoroughly convinced that it is one of the very importance sources, and that the facts as we know them today warrant the following general conclusions:

It is imperatively necessary for the protection of public health that all milk should be obtained from cows certainly free from tuberculosis, and from cows stabled, milked and pastured in an environment free from tuberculous infection, or that it should be pasteurized or sterilized before it is used as food in any form.

Some few years later Dr. Schroeder is reported to have given evidence that, while milk from a tuberculous cow "*might* attack a human being," infection could not be communicated except through a diseased udder; and that the tuberculin-testing of dairy cows does not "safeguard the public milk supply or safeguard dairy products;" and this information is being broadcast through the length and the breadth of the land today. If this report is true, then Schroeder must have had a change of opinions between 1908 and 1921. I am quite satisfied that he did not change his opinions much, if any, because on October 2, 1926, I heard him speak at the Fifth Conference of the International Union Against Tuberculosis in Washington and he said:

The excellent paper presented by Dr. Park, on "Tuberculosis and Milk," has so completely covered the subject on which he and I are in practically complete accord, that he has left very little for me to discuss.

I wish to say, emphatically, that no tuberculosis investigator who has examined the abundant data in the least degree doubts today that bovine tubercle bacilli cause serious, and fatally serious disease in children.

Hence even if the total amount of tuberculous disease and the total number of deaths from tuberculosis are not increased in communities in which raw, infected milk is consumed, this should not be used as an argument against the pasteurization of all milk that may contain bovine tubercle bacilli, or against the eradication of tuberculosis from dairy herds, or to justify the promiscuous exposure of children or adults to raw dairy products from tuberculous cattle.

Park himself, in a paper on "The Transmission of Tuberculosis in Childhood," published in the *Archives of Pediatrics*, July, 1915, said:

> In an investigation of the milk supply of New York City, undertaken several years ago, 16 per cent, of the samples taken from the loose raw milk supply in the stores contained sufficient bacilli in small amounts to cause tuberculosis in guinea pigs after subcutaneous injection. A number of investigators have shown that even when the udder is apparently normal a few bacilli may be found in the milk. The infection may be due at times to undetected deposits, but at others it is due to bacilli in the manure which, with the dirt, reaches the milk. It is thought that sufficient bacilli may enter the milk in this indirect way from infected cows to cause danger to those that drink it.

The third interim report of the British Royal Commission on Tuberculosis (1909) is devoted to the investigations of Dr. F. Griffith on the presence of tubercle bacilli in the milk and feces of cows not showing any signs of disease of the udder during life.

Dr. Griffith's researches, fully accepted and endorsed by the Royal Commissioners, conclusively show that both the milk and the feces of cows, clinically tuberculous but with no disease of the udder, are liable to contain living and virulent tubercle bacilli, and often contain them in very large numbers; and that cows, positive reactors not manifestly diseased, showed tubercle bacilli in the feces but they were not found in the milk.

In their review of the experiments summarized above, the Royal Commissioners remark:

> The presence of tubercle bacilli in the milk of cows clinically recognizable as tuberculous confirms the opinion we expressed in our second interim report that the milk of such cows must be considered dangerous for human beings. The experiments which we have carried out with regard to the infectivity of the faeces of tuberculous cows were dictated by knowledge of the fact that dirt of various kinds from cows and cowsheds is almost constantly present in milk as it reaches the consumer. Cows suffering from extensive tuberculosis of the lungs must discharge considerable numbers of bacilli from the air passages in the act of coughing, and some of the bacilli thus expelled may find their way into the milk. But our experiments indicate that the excrement of cows obviously suffering from tuberculosis of the lungs or alimentary canal must be regarded as much more dangerous than the matter discharged from the mouth or nostrils. We have found that even in the case of cows with slight tuberculous lesions tubercle bacilli in small numbers are discharged in the faeces, while, as regards cows clinically tuberculous, our experiments show that the faeces contain large numbers of living and virulent tubercle bacilli.

In 1899, Rabinowitsch and Kempner published an important investigation on the milk of cows reacting to tuberculin. They examined the milk of fourteen animals, only one of which exhibited disease of the udder manifest by physical examination; but in ten out of these fourteen they succeeded in proving that tubercle bacilli were present in the milk which the animals yielded.

In 1907, Dr. J. R. Mohler, Chief of the Pathological Division of the U. S. Bureau of Animal Industry, reviewing the evidence which had been accumulated on this subject, wrote as follows:

> That milk coming from a tuberculous udder is capable of transmitting the infectious principle is conceded by all those who have given the subject any consideration. It has been equally established that in advanced generalized tuberculosis, the udder may secrete tubercle bacilli without showing any indication of being affected. Careful experiments performed by trained and eminently responsible investigators have also demonstrated beyond reasonable doubt that tubercle bacilli at certain times may be present in the milk of cows affected with tuberculosis to a degree that can be detected only by the tuberculin test, so that in a herd of cows in the various stages of tuberculosis it is to be expected that some of them will secrete tuberculous milk, which, when mixed with the other cows' milk, makes the entire product dangerous.

The elaborate researches of Professor Delepine, of Manchester, have shown that probably about 10 per cent of the mixed milk which is supplied to our large cities is capable of infecting guinea pigs with tuberculosis. He has shown that one part of the milk from a cow with a tuberculous udder, when added to 100,000 parts of non-tuberculous milk, is capable of infecting guinea pigs and that therefore one cow with a tuberculous udder is capable of infecting the mixed milk from a large herd.

In the *British Journal of Hygiene*, November, 1927, there appears an article on "Tubercle Bacilli in the Faeces of Apparently Healthy Cows," by R. Stenhouse Williams and W. A. Hoy (National Institute for Research in Dairying).

> Complete tests were obtained in 391 instances. (By a complete test is meant one in which both of the test guinea pigs lived longer than 42 days.) When possible the guinea pigs were kept for 100 days before they were killed. The 391 complete tests yielded six positive results.
>
> If the positive results which were obtained be expressed as a percentage of the 391 complete tests, it is found that 1.53 per cent of the samples showed the presence of living virulent tubercle bacilli.
>
> None of the six cows found to have the tubercle bacilli in their feces had been tested with tuberculin.
>
> It is important to remember that only one sample was taken from each cow, and that not more than one ounce out of the thirty to forty pounds of feces which a cow excretes in a day was examined, that further results which we shall publish later demonstrate that, when treated by these methods, tubercle bacilli were only found at irregular intervals in the feces of cows which were known to be infected.
>
> The positive results which have been obtained, therefore, may be fewer than those which might have been obtained by more perfect methods.

Rabagliati, writing on "Some Aspects of Bovine Tuberculosis," in the *Veterinary Record* (1928, v. 8, 61-6), says:

> Milk is a much greater source of human infection than is meat, but the detection of the disease clinically in cows is often difficult as bacilli may be excreted without any symptoms existing or they may be intermittent in obvious cases and not present during any particular examination. A definite clinical diagnosis of udder tuberculosis, except in late states, is not possible and it is necessary to examine the milk miscroscopically or even to inoculate animals. A cow with tuberculosis of any organ is potentially dangerous.

Calmette, in his book, "Tuberculosis in Man and Animals," says:

Apparently healthy cows, free from udder lesions but reacting to tuberculin, eliminate virulent tubercle bacilli from time to time either in their dejections or in their milk.

* * *

It is not only the cows with mammary gland lesions which constitute a grave danger, since their number is relatively small, but the experiments of Rabinowitsch and Kempner, those of Adami and Martin, of Gehrmann and Evans, of Mohler, of Moussu, have shown that even the milk of animals which have no clinically demonstrable mammary lesions and which simply react to tuberculin may now and then and intermittently contain bacilli.

And again he says:

Like the normal kidney, the normal mammary gland does not permit the passage of bacteria. But blood infections and particularly tuberculous bacillemia, may lead to the formation of small inflammatory foci round about one or several functionally active glandular acini, or bring about tuberculous lesions. In both cases the leucocytes which are capable of transporting the bacilli pass into the lacteal secretion.

Lydia Rabinowitsch and Kemper, Karlinski, in Germany, Moussu in France, John Mohler, Schroeder and Cotton in the U. S., and Sheridan Delepine of the Royal English Commission have published facts which prove indisputably that cows and also goats, apparently free from any mammary lesions, but reacting to tuberculin, expel bacilli now and then in the milk which they secrete.

Dr. L. VanEs, in Circular No. 23, February, 1924, published by the University of Nebraska, says:

Of primary importance in this connection is the discharge which issues from the respiratory tract in cases of tuberculous lung disease. This must always be regarded as the principal means by which the germs of tuberculosis are eliminated from the body. Contained in the discharge mentioned, they may be directly cast out during coughing fits or by the slower discharge of mucus through the nostrils.

This is, however, by no means the only avenue open to this virulent material for its escape from the body. In fact the greater part of respiratory discharge is neither coughed out nor expelled through the nose but is swallowed by the animal concerned; and while the mucus and other matter which constitutes its bulk may be subsequently digested, the bacilli for a large part are not affected by the process and appear in the feces alive and fully virulent.

Owing to this feature, therefore, the manure of animals affected with lung tuberculosis must be looked upon as being of an infectious nature. Needless to say, in tuberculous disease of the intestines or the liver the same means of exit is open to the infection.

In the tuberculosis of the kidneys and other portions of the urinary tract, the urine commonly is the vehicle which carries the bacilli on their outward journey.

The semen may serve the same purpose when the testicles harbor disintegrating lesions. In tuberculosis of the female reproductive organs the vaginal discharge is commonly virulent.

The milk must always be regarded as being infectious when udder tuberculosis is present; and even in cases of tuberculosis in other parts of the body, but with no appreciable udder lesions, the milk is frequently contaminated by the bacilli. It is this feature above all which has made the elimination of the tuberculous milch cow an important factor in the protection of public health.

* * *

Milk derived from the tuberculous udder may be extremely rich in bacilli. As many as 100,000 tubercle bacilli have been found to be contained in one cubic centimeter of milk and in some instances it was still possible to prove its virulence when the original product was diluted one billion times.

But not only do the cows with tuberculous udder disease eliminate the bacilli through the milk. Many investigations have resulted in showing that cows without appreciable udder lesions but reacting to the tuberculin test may yield a milk in which tubercle bacilli are present.

In such animals the elimination of the bacilli through the milk may not be a constant feature; in fact, it frequently is of an intermittent character.

For practical purposes, therefore, the milk of a reacting cow must always be looked upon as a real or potential means of conveying the infection to other animals or to man. It must be regarded as a source of danger to infants and children when consumed in the raw state in considerable quantities and during a prolonged space of time.

Milk not only becomes contaminated by tubercle bacilli within the udder of the tuberculous cow, but it may become thus polluted after being drawn by stable dust or fecal matter during the act of milking in infected stables.

As has already been pointed out, bacilli can escape from the tuberculous animal by means of the bowel discharges, and in infected stables this material is very apt to contaminate the milk of the healthy members of the herd.

Thus not only does the milk of the tuberculous cow constitute a source of danger to other animals and man, but the milk of a stable or herd in which the disease is present can never be regarded as absolutely harmless even if it were known that the animals producing it were free from infection.

A comparison of the occurrence of tuberculosis in breast-fed children, with the frequency of the disease in children receiving cow's milk, was made by Sobotta. Of 80 exclusively breast-fed children, 17.5 per cent were infected with tuberculosis; of 57 children receiving cows' milk in addition to mother's milk, 35.1 per cent were infected, and of 30 fed exclusively on cows' milk 41 per cent became tuberculous.

Klein, in his book, "Principles and Practice of Milk Hygiene," discussing cows with apparently normal udders but showing clinical symptoms in other organs or parts, says:

Milk from cows in this condition frequently contains tubercle bacilli. It appears very probable that the udder is actually diseased when tubercle bacilli are eliminated in the milk of such cows. The udder may be tuberculous and yet be apparently normal. The disease is always extensive when clinical symptoms are present, and usually it is generalized—tubercle bacilli have repeatedly invaded the blood stream and have had abundant opportunity to locate in the udder and to produce small, fresh tubercles, too small to be discovered by palpation of the udder. Such lesions may even escape observation on post-mortem examination because of their similarity in appearance to the actively secreting udder tissue. Rick found the udder tuberculous in 17.6 per cent of the cases of generalized tuberculosis examined by him. Joest and Kracht found the supramammary lymph glands tuberculous, when tested by inoculation, in 50 per cent of the cases examined by them of generalized tuberculosis in which the udder did not show any clinical symptoms or microscopic lesions on post-mortem examination; some of the lymph glands were slightly enlarged but otherwise they were of normal appearance. In one-half of these cases the udder tissue was also infected. It would therefore appear that the udder is much more frequently tuberculous in cases of generalized tuberculosis than is generally suspected.

Klein again says:

Milk may be infected secondarily with tubercle bacilli when open tuberculosis is present in the lungs, intestines, or uterus. Cows affected with open tuberculosis of the lungs swallow the greater part of the infected material coughed up, and it passes out with the feces; the tubercle bacilli are not destroyed by the digestive secretions and remain virulent.

In cows which do not show any clinical symptoms which but have reacted to the tuberculin test (non-clinical reactors) . . . Rabinowitsch and Kemper, Schroeder, Ravenel, Mohler, Martel, Guerin, DeJong, Moussu, and Fay have found tubercle bacilli present in milk from such cows.

Heineman, in his book, "Milk," says:

One of the most important means of communicating tuberculosis is through the excretion of large numbers of the bacillus with the feces of tuberculous cattle. It has been estimated that about 40% of tuberculous cattle which give no outward indication of the disease discharge tubercle bacilli with their excreta. After initial infection there is a period without discharge of tubercle bacilli in the dejecta and this fact complicates the difficulties of ridding a herd of tuberculosis. Some bacilli are also expelled from the mouth and perhaps from the nose. Since tubercle bacilli are discharged in large numbers with feces, it follows that market milk is frequently contaminated with them. Investigators in various cities have given the percentage of market milk containing tubercle bacilli at 5-17, and even higher. A conservative estimate might place the average at 6-8 per cent. Milk from the same source will not always contain tubercle bacilli, and the relative numbers when they are present will vary. Therefore it is essential that a series of tests be made from each milk-supply. The usual experience is that tubercle bacilli appear in the milk intermittently, and that sometimes they are so scarce that when several guinea-pigs are inoculated but one of them will contract tuberculosis. Milk-supplies which contain tubercle bacilli at intervals are especially dangerous, since a false sense of security may be created by not finding the bacilli in every sample. It is more important to learn which supplies may occasionally contain tubercle bacilli than to determine the actual percentage of milk infected. In the main, tubercle bacilli enter milk from either excreta or diseased udders. They may be derived from excreta, whether these are dislodged from the coat of the animal during milking or from dust in the air. These dejecta communicate bacilli to the milk through the air or by any other means which permit the entrance of cow manure into milk.

Jordan and Arms found that 26.66 per cent of feces from cows which were shown to be tuberculous by the tuberculin test and by autopsy contained tubercle bacilli.

Unquestionably, a large percentage of tuberculous animals discharge tubercle bacilli with their feces, and from this source the bacteria easily gain access to milk. The consequence is that milk from perfectly healthy animals may become contaminated with tubercle bacilli.

Dr. T. B. Magath, Section of Clinical Pathology, Mayo Clinic, in a paper before the First Southwestern Tuberculosis Conference, February, 1928, said:

In outlining any programs for the control of disease the mode of transmission must be understood. We sometimes form certain conclusions from a study of the incidence of a disease. The high incidence of bovine tuberculosis in children makes it evident that the child is either more susceptible to it than the adult or comes in contact with it more often. Although the child may be more susceptible than the adult to all forms of tuberculosis, it does not explain this high incidence and the conclusion seems inevitable that the child comes in contact with the bovine tuberculosis more often than does the adult. While the incidence of bovine tuberculosis is highest in children under five years, it is extremely low in

children under one year. These facts immediately suggest the importance of milk as a source of infection in children since a large percentage of infants under one year does not have access to raw cow's milk. If one were to plat the consumption of cow's milk by age groups the curve would follow closely the incidence of bovine tuberculosis. At ages when children are drinking cow's milk in largest quantities, the incidence of bovine tuberculosis is highest. This invites attention to the incidence of tuberculosis in cattle.

The very fact that bovine tuberculosis in the human being is a disease of the gastro-intestinal tract, the lymphatics, the bones and joints, as contrasted with pulmonary tuberculosis, indicates that this form is contracted not through inhalation and direct contact but by the ingestion of bacteria. It may be safely assumed that one rarely eats tuberculous meat and even if one did, by the time it has passed through the cooking process it could be considered relatively safe. The conclusion is inevitable that the ingestion of raw milk from tuberculous cows accounts for practically all of the bovine tuberculosis of mankind.

Bovine tuberculosis is rare in Paris, which recalls the fact that infants are rarely ever fed any but boiled milk in France. In Great Britain the incidence of bovine tuberculosis is high and goes with the fact that not only is the percentage of tuberculosis high in cattle in that country but boiled milk has not been used generally.

It is a question of years of education and propaganda to bring any such ideal as completely pasteurized milk into being and so it would seem logical in this problem, as in almost all others, not to put all of one's eggs into one basket. By far the best method would appear to encourage the testing and eliminating of cattle that are tuberculous and at the same time to encourage the use of properly pasteurized milk and milk products.

That this dread disease is being rapidly conquered is without controversy but it is obvious that this is not the time to rest on one's oars and to swell up with pride for what has been done, rather than it is the time to bend one's back to the task that lies before one, that ere another twenty-five years has passed, the incidence of tuberculosis may be reduced to an insignificant figure, and that bovine tuberculosis, the easiest form to eradicate, may be eliminated from the ills of mankind.

. . . The meeting adjourned at 12:30 p. m.

ADJOURNMENT

THURSDAY AFTERNOON, DECEMBER 6, 1928

The fourth session convened at 2:00 p. m., President Cary presiding.

PRESIDENT CARY: The first paper on the program is by Dr. Max Pinner, Director of Laboratory, Detroit Municipal Tuberculosis Sanitarium, of Northville, Michigan. Dr. Pinner. (Applause)

LESIONS OF TUBERCULOSIS

By MAX PINNER, *Northville, Mich.*

Director of Laboratory, Detroit Municipal Tuberculosis Sanitarium

MR. PRESIDENT AND GENTLEMEN:

Some little time ago, I asked one of our rather prominent speakers the reason for the fact that so many talks of a scientific nature or otherwise were started with a funny story. He answered without hesitation that there were two reasons: First, to give the audience a chance to recover from seeing the speaker

rise, and second, to give the speaker a chance to recover from being called upon. This second reason in the present instance would be particularly important in speaking before an audience of veterinarians, because I know nothing about veterinary medicine and especially tuberculosis in cattle. Your Program Committee is fully aware of this fact and the fact that they asked me, in spite of that, shows me that they feel the same way about this.

Veterinary medicine and human medicine, particularly in the field of tuberculosis, have very close and important points of contact.

There are just three or four points that I should like to mention in particular this afternoon. First of all is the incidence of bovine tuberculosis in the human. You have heard the paper on this subject already and I want to mention, in a preliminary way, a few results which we have had in our work in the Municipal Tuberculosis Sanitarium in Detroit. We have typed about 25 strains of tubercle bacilli from non-pulmonary tuberculosis in children below the age of fifteen. In this type of disease the incidence of bovine tuberculosis is relatively high. The report from Park, in 1912 or 1913, indicated the incidence to be somewhere around 50 per cent or more.

We have so far typed only 25 strains and the results, for that reason, are far from complete. We want to have very much larger figures. I am glad to be able to report this preliminary result first and that is, that out of those 25 strains we have not found a single bovine strain. You know the City of Detroit has had a pasteurization ordinance for a number of years.

A second point of contact between the two fields refers to the methods which are used in the pathologic and anatomic world. The veterinarian can kill and may examine the animal at almost any stage of the disease after it is discovered. This gives an opportunity to study the lesions at the various stages of development and very important findings have been obtained in this way. We, of course, have to wait for the spontaneous death of the patient, and if the patient does die of tuberculosis, we see only far-advanced lesions. It is more or less a matter of chance to find less-advanced lesions in patients who die of some other type of disease.

On the other side, human medicine has one method available which is very seldom available for veterinary medicine and that is the continuous clinical observation over a long period of time,

helped by extra studies which are, of course, particularly important in the case of pulmonary tuberculosis. I intend to mention one particular example a little later.

It is interesting to compare, from the two fields, the type of fight against the disease which is carried on, and I think it can be said quite pointedly that the veterinarian fights the infection. We can fight only the disease, and it must be well understood that there are very important differences between a mere infection, which does not give rise to a demonstrable disease, and actual and active disease. Of course, from the human side, we can be interested only in actual disease, not in infection. This difference in the attack of the problem is particularly important in regard to tuberculin tests. A tuberculin reaction means for us simply that a person is *infected* with tuberculosis. It does not tell us whether this patient is *diseased* with tuberculosis. As far as your interests are concerned, you are satisfied that the animal is infected and should be disposed of.

What different things generally are said to make an animal or human react to tuberculin? First of all, we have the advanced cases where we have actual, manifest, active, wide-spread lesions. There is no discussion necessary in this regard. Secondly, we have a smaller group, at least in animals, where we have only small lesions, where we have in fact those small lesions which are difficult to find, sometimes so small that they are not found at all. The question or theory, I think, has been advanced that simply the presence of tubercle bacilli in the body, without causing any destruction of the organ in which they may be, may cause a positive tuberculin reaction. Then there is what is biologically called a symbiosis between the host and the cattle bacilli, which may be sufficient to give a positive tuberculin test. The most important question remaining is: Can anything but those three things mentioned cause a positive tuberculin reaction? Can any other constitutional condition in the human or in an animal cause a tuberculin reaction?

A few years ago, the late Dr. Schroeder mentioned, in a tuberculosis conference, in Washington, D. C., that in a study including microscopic histologic examination, he found that in all but 0.25 per cent of reactors it was possible to demonstrate lesions of tuberculosis. This brings me to the chief part of this discussion.

The Program Committee was very generous in putting the title down as "Lesions of Tuberculosis," a subject which is vast enough to talk on for a few days. It was, of course, necessary to

limit the discussion to one particular part, and considering your interests, I thought it might be of interest to show you, from human material (as, I say, I have no bovine material), some typical and small lesions, that is, lesions which could very easily have been missed at autopsy.

If we perform an autopsy on a human, we figure that it takes us an average of two hours to make a complete autopsy, which of course does not include any histological or bacteriological work. Of course, it is well understood that the veterinarian in his work cannot spend the same amount of time on a carcass. Furthermore, it has to be considered that the carcass is very much larger and there is a possibility of not seeing lesions which are fully large enough to cause a tuberculin reaction.

When we are particularly interested in our work to find every bit of tuberculous lesion which may be present, we cannot succeed with the usual autopsy methods. The method which is frequently used and which I have used a good deal in our work in Detroit is to harden at least the entire respiratory organs. After a certain amount of fixation is obtained, I cut the organs into slices of not more than two millimeters in thickness. If this is done, especially on patients who do not die of tuberculosis, we find a very much larger number of demonstrable tuberculosis lesions than we do in the ordinary autopsy technic. That, again, is a method which cannot be applied to practical work, but which again would show how many more lesions would probably be found, say, for a scientific study, if such methods could be used in a certain series of animals.

There are two types of lesion especially that I should like to show to you, which are of interest from this point of view. One is the very young lesion, and the other is a very old lesion. Between these two extremes of tuberculosis there are many different types of pathologic and anatomic manifestations. At the beginning and at the end, there are the two types of lesions which are probably most easily overlooked because of their smallness.

(Slide 1) The first slide shows you just what we call a miliary tubercle in pulmonary tissue. You see that around the outer part of the slide we have normal lung tissue and in the center there is a small nodule, composed of various types of cells and containing a typical so-called Langhans' giant-cell in the center.

(Slide 2) This is a higher magnification of a similar lesion. I should like to mention briefly the history of this case. This sec-

tion comes from a boy who died, not of pulmonary tuberculosis, but I kept him so long at autopsy because I wanted to have a normal lung, and looking at the lung roughly it appeared to be perfectly normal. The histologic sections showed this type of tubercles, not a few but thousands, spread throughout the lung. After I realized my mistake, I went back to the specimen which was perfectly well preserved and found a million tubercles throughout the entire organ which I had not been able to see before.

So you see that this type of lesion, if it happens to be found in the very early stage, may be so small that it cannot be seen with the naked eye and only with histologic and bacteriologic examination would this particular tubercle be revealed. The average size of tubercle in this particular lung, according to micrometric measurement, was 1/250 of an inch in diameter, so this oversight was excusable.

(Slide 3) This is another type of lesion. This represents what we call in human pathology the primary focus which, in the majority of cases, occurs in the lung. This lesion is, in many humans, the only tuberculous lesion present. It was so with one small exception in this case. You see in the lower part of the slide the normal lung tissue, then the darker part indicates a connective tissue capsule (this slide is stained for reticular tissue), and in the upper two quadrants you see a caseated mass between the extension of the capsule. These primary foci are well-encapsulated, caseated areas and may contain tubercle bacilli and are frequently the only tuberculous lesions in the body, yet sufficient, as has been proven by hundreds and hundreds of experiences, to elicit a tuberculin reaction.

(Slide 4) You see in the lower part of this heavy strand of connective tissue, which makes a complete capsule, practically no nuclei in this tissue, and the upper part of the slide is occupied by a partly calcified and otherwise caseated center. The size of this particular lesion was one-fifth of an inch in diameter and surrounded by perfectly normal appearing glandular tissue, and only upon sectioning the small gland and feeling the grating of the knife on the calcified deposits could we find the little cheesy and chalky centers.

(Slide 5) This is a similar lesion. The center in this lesion is completely calcified and again surrounded by dense and rather hyalinized connective tissue at the capsule.

(Slide 6) This is another type of lesion which is just probably a good representative for a healed pulmonary tuberculous lesion. The center again consists of a caseated and partly calcified lesion. The capsule is similar to the capsules that I have shown before, heavy strands of connective tissue impregnated with much coal pigment. This is not a primary focus but a secondary infection. Those foci have been described under the name of Poole foci from the name of the author who described them first. Those lesions may have any size, from the point of a needle to about 0.1 or 0.2 centimeters in diameter, but still are lesions which easily escape detection.

(Slide 7) In this last slide we have again, in the upper part, one of those calcified lesions. Most of the calcified material has been lost in decalcification and in cutting, but the heavy capsule is left. I am showing this particular slide for a very particular reason, because you will ask, or at least the anti-tuberculinist might ask, what is the significance of such small lesions, especially like those I showed? They are well encapsulated and should one really sacrifice an animal because such small lesions may be the only ones and give rise to a tuberculin reaction?

We observed this girl for many years. She started with an active pulmonary tuberculosis involving the upper half of both lungs. We had very frequent X-ray examinations and saw the process resulting; the small nodules become smaller, sharply defined, and finally appeared as small definite calcified peppercorns, spread irregularly throughout the upper half of the lung. In the meantime the child made a very good clinical recovery and was, to all intents and purposes, well. Repeated X-ray examination always showed the same condition, just sharply calcified lesions, no other pathology and, as I say, clinically the child was perfectly healthy.

Suddenly, at the age of puberty (always a dangerous age for children with tuberculosis), she developed an acute disease and died within one year. This disease was nothing but an acute exacerbation of these encapsulated and calcified nodules, which could be very easily shown in the X-ray series that we had on this case. I think this probably suffices to answer any such objection as I mention. We do not know from lesions which to all appearances are anatomically healed, calcified with a thick fibrous capsule around them, whether under certain circumstances of life they may again exacerbate and cause an acute spreading of the disease. It seems to me, from the evidence we have and from

the bit of evidence that we have from our work and your work and some of those examples that I have mentioned today, that from the standpoint of etiology we must continue to do what you have done with such a great amount of success: To regard every animal which reacts to tuberculin either as actually diseased, or, if actual disease cannot be shown, as a potential spreader of the disease at an early or later date.

It seems to me further that, at the present state of our knowledge and without the evidence that we have on this subject, this question of the so-called no-lesion reactor is very well settled. The possible percentage is extremely small and, I do believe, provided the technic of the test is correct, that there are none if we could examine every carcass as thoroughly as we can examine a human in postmortem examination for special scientific purposes. It seems to me that a much more important question than this should probably deserve some consideration, and that is, whether we may not miss the tuberculin test occasionally in some animals having tuberculosis. I do think this question where some animals actually do have tuberculosis and probably do not react to the tuberculin is of greater practical importance at the present time than the question of the no-lesionreactor.

I have heard you speak frequently of the so-called irreducible minimum in tuberculosis in herds. I have a slight suspicion that this irreducible minimum may be due to a failure of the tuberculin reaction on the positive side, but not on the negative side.

President Cary: We will go to the next paper, "The Relation of Acid-Fast and Skin Infections of Cattle to Bovine Tuberculosis and Other Acid-Fast Infections," by Dr. Jacob Traum, University of California, Berkeley, California. (Applause)

. . . Dr. Traum read his paper. . . .

THE RELATION OF ACID-FAST SKIN INFECTIONS OF CATTLE TO BOVINE TUBERCULOSIS AND OTHER ACID-FAST INFECTIONS

By Jacob Traum, *Berkeley, Calif.*

Division of Veterinary Science, Agricultural Experiment Station, University of California

The disease which is to be discussed this afternoon, I consider as one of the most important problems in the country's huge bovine tuberculosis eradication project. This importance is especially evident in accredited herds or in those in the process of

accreditation and in herds and communities where the number of reactors is very low.

On three occasions I reported a disease in cattle which I called lymphangitis caused by an acid-fast organism. These reports were made in 1916,[1] 1919[2] and 1923.[3] Since my first report, the disease has been found in many parts of the country and described under various names: "skin tuberculosis," "tuberculosis cutis," "subcutaneous tubercular nodules," "skin lesions in tuberculin-reacting cattle," and, at this time, I have selected a new name. I do not know whether or not all my cases are alike in their etiology and I do not know that all or most of the cases described under these various headings by others are similar in pathology (including the causative agent) to most of the cases encountered by me. Each of the names suggested has some justification for its use. I have purposely omitted reference to tuberculosis in the names. It really matters very little what name or names are given until the oneness or plurality of the acid-fast incitant of the conditions described under the various headings is satisfactorily agreed upon.

Only casual mention will be made at this time of the character and location of the lesions. Most of you are acquainted with these and, for further details, you are referred to reports already published by others[4,5,6] and by me. From the descriptions, you will note that differences in the character of the lesions are mentioned by the same and by different workers. These, however, are of minor importance because too much stress in final diagnosis cannot be placed upon gross and, for that matter in some instances, upon microscopic appearance of the lesions. I have previously reported two cases of a definitely proven Preisz-Nocard[7] infection in cattle, in which the gross picture is very much like those under discussion. In table I, case 1, you will find another case of subcutaneous nodular disease in cattle in which the Preisz-Nocard organism was found. These cases, however, are not difficult to detect by culture and guinea pig inoculations.

One of the principal findings that groups together the cases from all parts of the country is the presence of acid-fast organisms in the lesions. Morphologic distinctions of the various pathogenic and saprophytic acid-fasts are often mentioned. These however, are not safe guides in differentiating species or types, and, to place definitely acid-fasts found in any lesion, their behavior in experiment animals, in cultures and, to a lesser extent in serologic tests, has been resorted to. This is not always found

necessary because experience has taught us that certain lesions containing acid-fasts will invariably produce inoculation-tuberculosis in our experiment animals. Such a condition, you all know, is not found in these skin lesions.*

Cultures made, with few exceptions, have remained sterile or have failed to develop an acid-fast organism. Guinea pigs, rabbits, cattle, chickens and other animals also, with few exceptions, have remained uninfected by the injection of material from skin lesions containing acid-fast organisms. The few successful animal transmissions and artificial cultivations will be discussed in another portion of this paper.

It is claimed by many that the acid-fasts found in these skin lesions were originally bovine tubercle bacilli, and it follows naturally that the failure to produce lesions in the usual test animals must be attributed either to attenuation or death of the organisms, and the failure to obtain cultures to death of the organisms.

As an example of attenuation of tubercle bacilli in the animal body, lupus vulgaris[8,9] in man has been mentioned because lupus has generally been described as being due to an attenuated tuberculous virus. Agreement in the histopathology[9] of lupus and the skin lesions has been described. Hieronymi,[10] however, states that lupous changes in the animal skin are found only in the rare tuberculosis of the vulva. Crawford[11] has already called attention to the fact that a difference in localization of the lesions in the two diseases exists. Lupus is invariably found in the skin proper, whereas the lesions in the disease under discussion are predominantly subcutaneous. I have found some cases invading the skin with little or no macroscopic evidence of subcutaneous involvement. Within the past year there have come to my attention three cases in which the lesions containing large numbers of acid-fasts were situated in the muscles of the shoulder or of the chest-wall. The subcutaneous location of the disease processes, however, is by far the most frequent.

Another difference is that lupus is usually associated with a disease elsewhere in the body. In acid-fast skin lesions of cattle, this may or may not be the case. More often it is not. Of the thirty-eight cases being reported by me this afternoon (twenty-six of which have been autopsied), none of the animals showed

*Skin lesion is frequently used in this paper because of its brevity, but includes all the conditions referred to by the various investigators.

TABLE I.—*Result of animal inoculation of suspected material*

Herd	Case	Reaction to Tuberculin (Intradermal Test)	Animal Inoculations					Remarks
			Species	Number	Mode of Inoculation	Days after Inoculation	Result	
2	1	See remarks	G. P.	268	Intramusc.	104	Negative	Nodules from 18 cows (none positive tuberculin reactors) were removed surgically and brought to the laboratory in one container. Several of the cleanest and non-incised nodules were used for animal inoculation. Acid-fasts were found. Cultures and reinoculations from G. P. 269 proved definitely Preisz-Nocard infection. G. P. 268 and 269, tuberculin-tested three months after injection proved negative
			G. P.	269	Intra-abdom.	104	Preisz-Nocard infection	
			Rabbit	A	Subcu. and intra-abdom.	104	Negative	
			Rabbit	B	Intrav.	104	Negative	
			Cockerel	1603	Intrav.	104	Negative	
			Cockerel	1605	Subcu.	104	Negative	
6	2	Positive	G. P.	1	Intramusc.	81	Negative	Lesions moderate. G. P.'s tuberculin-tested at 76 days after injection negative to avian and mammalian tuberculins. Animal slaughtered; no other lesions found
			G. P.	2	Intra-abdom.	81	Negative	
			Cockerel		Intra-abdom.	81	Negative	
			Cockerel		Subcu. and intrav.	85	Negative	
7	3	Positive	G. P.	28	Intra-abdom.	101	Negative	Subcutaneous nodules—moderate involvement—few acid-fasts found. Rabbits 56 and 77 were in poor condition after inoculation—both killed on days mentioned. No evidence of tuberculosis. Material received in 50 per cent glycerin.* Animal slaughtered; no other lesions found
			G. P.	29	Subcu. and intraderm.	101	Negative	
			Rabbit	24	Intra-abdom.	77	Negative	
			Rabbit	25	Subcu. and intraderm.	57	Negative	
			Cockerel	26	Intra-abdom.	139	Negative	

*The effect of glycerin upon tubercle bacilli contained in lesions was tested in a small way in the following experiment. Tuberculous guinea-pig lesions were cut into pieces not over one centimeter in thickness. Some were placed in 100% glycerin having pH 5.5 and others in 100% glycerin with pH 8.2. Guinea pigs inoculated with material removed from glycerin at 52 and 168 hours respectively, developed tuberculosis.

TABLE I—*Continued*

Herd	Case	Reaction to Tuberculin (Intradermal Test)	Animal Inoculations: Species	Number	Mode of Inoculation	Days after Inoculation	Result	Remarks
5	4	Suspicious	G. P.	35	Intramusc.	82	Negative	Moderate skin lesions. Animal slaughtered; no other evidence of disease
			G. P.	36	Intra-abdom. and intraderm.	82	Negative	
5	5	Positive	G. P.	244	Intramusc. (See remarks)	73	Negative	G. P. 244 was injected with necrotic lesion in mesenteric lymph-node; other animals with skin lesions. Skin lesion cutaneous and subcutaneous about the knee and shoulder. Moderate involvement. Animal slaughtered; no other evidence of disease
			G. P.	245	Subcu.	91	Negative	
			G. P.	246	Intra-abdom.	91	Negative	
			Rabbit	247	Subcu.	84	Negative	
			Rabbit	248	Intrav.	91	Negative	
8	6	Positive	G. P.	285	Intramusc.	57	Negative	Involvement moderate; no further information. Acid-fast organisms found
			G. P.	286	Intra-abdom.	57	Negative	
			Rabbit	284	Subcu.	76	Negative	
8	7	Positive	G. P.	291	Intramusc.	102	Negative	Involvement moderate; no further information. Acid-fast organisms found
			G. P.	292	Intra-abdom.			
1	8	Positive	G. P.	325	Intramusc.	65	Negative	Ulcer above knee extending to subcutis. Slight involvement. Acid-fasts found. At the same time, a submaxillary lymph-node showed cream-colored and brownish caseous nodules which contained acid-fasts, which proved innocuous for guinea pigs, rabbits and chickens at 100 days
			G. P.	326		103	Negative	
9	9	Suspicious	G. P.	332	Intramusc.	103	Negative	Lesion moderate. B. A. I. report on same case negative G. P. after seven months. Acid-fasts found. See case 8, table IV

TABLE I—*Continued*

Herd	Case	Reaction to Tuberculin (Intradermal Test)	Animal Inoculations: Species	Number	Mode of Inoculation	Days after Inoculation	Result	Remarks
5	10	Positive	G. P.	350	Intra-abdom.	76	Negative	Extensive skin and subcutaneous lesions. Two sets of animals injected; first with lesions removed surgically, second with lesions after slaughter. No lesions found elsewhere in the body. See case 7, table IV
			G. P.	351	Intramusc.	141	Negative	
			Rabbit	352	Subcu.	141	Negative	
			G. P.	364	Subcu.	156	Negative	
			G. P.	365	Intramusc.	84	Negative	
			Rabbit	366	Intrav. and subcu.	129	Negative	
			G. P.	374	Popliteal gland intramusc.	154	Negative	
			Cow	1662	Subcu.	64	Negative	Cow 1662 negative to tuberculin test before slaughter
1	11	Positive......	G. P.	368	Intrad.	155	Negative	Extensive involvement in front leg from carpal joints to shoulder, with lesions in the prescapular gland. Most were subcutaneously located. At one point, the process was apparently associated with the skin. Animal slaughtered; showed no other evidence of disease. Fair number of acid-fasts found. Cow 1438, negative to tuberculin test before slaughter
			G. P.	369	Intramusc.	63	Negative	
			G. P.	371	Intramusc.	154	Negative	
			G. P.	370	Intramusc.	162	Negative	
			Rabbit	372	Intrav. and subcu.	136	Negative	
			Cow	1438	Subcu. and intrad.	259	Negative	
1	12	Positive	G. P.	372	Subcu.	154	Negative	Slight lesion subcutaneously situated. Animal slaughtered; no other lesions found. Acid-fasts present
2	13	Positive	G. P.	375	Subcu.	150	Negative	Moderate involvement. Pierced through the skin. Fair number of acid-fasts found. Animals slaughtered; no lesions elsewhere in the body
			G. P.	376	Intramusc.	70	Negative	
			Rabbit	377	Intrav. and subcu.	150	Negative	

TABLE I—*Continued*

Herd	Case	Reaction to Tuberculin (Intradermal Test)	Animal Inoculations: Species	Number	Mode of Inoculation	Days after Inoculation	Result	Remarks
2	14	Mild reaction	G. P.	382	Intramusc.	152	Negative	Extensive involvement in front limb around the knee and in the hind limb at tarsus and lower. Mostly subcutaneous, at certain points adhering to the skin.
			G. P.	383	Subcu. and intrad.	64	Negative	G. P. 383 showed 12 x 7 x 1 mm. yellowish necrotic area in the abdominal wall muscles at the point of inoculation. No acid-fasts found, and reinoculated into G. P. 450 intrad. and subcu. Destroyed 163 days with negative results.
			G. P.	384	Subcu. and intrad.	59	Negative	
			Rabbit	385	Intrav. and subcu.	153	Positive	Rabbit 385 showed a 5-mm. nodule with a large number of acid-fasts in right lung. Re-inoculation into guinea pig subcutaneously caused local lymph-gland involvement only. Intravenously inoculated into rabbit, showed lesions in lungs only when destroyed at 120 days. Culture appears to be a rapidly growing mammalian type in first generation. Virulence tests now being made
2	15	Positive	G. P.	379	Intramusc.	64	Negative	Extensive skin lesions. Animal slaughtered. No lesions found elsewhere. Large numbers of acid-fasts found.
			G. P.	380	Intra-abdom. and subcu.	150	Negative	
			Rabbit	381	Intrav. and subcu.	150	Negative	Rabbit 381 showed local nodule with acid-fast. Re-inoculation into G. P. subcutaneously and into rabbit intravenously failed to induce any lesions when autopsied at the end of 120 days
5	16	Suspicious Negative to ophthalmic	G. P.	429	Intramusc.	70	Negative	Moderate skin lesions. Animal slaughtered. No other lesions found elsewhere in body. Fair number of acid-fasts found.
			G. P.	430	Subcu.	167	Negative	
			G. P.	431	Intra-abdom.	167	Negative	
			Rabbit	435	Intrav. and subcu.	112	Negative	Rabbit 435 was injured and, therefore, killed at 112 days

TABLE I—*Continued*

HERD	CASE	REACTION TO TUBERCULIN (INTRADERMAL TEST)	ANIMAL INOCULATIONS					REMARKS
			SPECIES	NUMBER	MODE OF INOCULATION	DAYS AFTER INOCULATION	RESULT	
5	17	Positive to intradermal and also to ophthalmic test	G. P.	432	Intramusc.	167	Negative	Moderate lesions in right front limb subcutaneously situated above carpal joint. Animal slaughtered. No other lesions found. Fair number of acid-fasts found. Rabbit 435 was injected with material from cases 16 and 17
5	18	Mild reaction to both intradermal and ophthalmic tests	G. P.	436	Intramusc.	72	Negative	Severe involvement, coronet to carpal joint. Animal slaughtered. No acid-fasts found. No lesions elsewhere in the body. Rabbit 442 died of hemorrhagic enteritis
			G. P.	437	Subcu.	72	Negative	
			G. P.	438	Intra-abdom.	167	Negative	
			Rabbit	442	Intrav. and subcu.	136	Negative	
5	19	Mild reaction to both intradermal and ophthalmic tests	G. P.	439	Intramusc.	168	Negative	Moderate involvement. Animal slaughtered. No lesions elsewhere in the body. Very large number of acid-fasts found; 90 in 50 fields
			G. P.	440	Subcu.	70	Negative	
			G. P.	441	Intra-abdom. and subcu.	168	Negative	
			Rabbit	446	Intrav. and subcu.	168	Negative	
5	20	Positive	G. P.	443	Intramusc.	144	Negative	Moderate skin lesions. Animal slaughtered; no other lesions elsewhere in the body. Fair number of acid-fasts found. G. P. 443 died of intercurrent disease. Rabbit 442 injected with combined materials of cases 18 and 20. See case 3, table IV
			G. P.	444	Subcu.	70	Negative	
			G. P.	445	Intra-abdom.	167	Negative	
			Rabbit	442	Subcu. and intrav.	136	Negative	
10	21	Positive	G. P.	447	Intra-abdom. (with prescap. gl.)	169	Negative	Extensive involvement of subcutaneous tissue and muscles of left chest wall and shoulder to the scapulo-humeral joint. Animal slaughtered; no lesions elsewhere in the body. Fair number of acid-fasts present
			G. P.	448	Intra-abdom.	105	Negative	
			G. P.	449	Intramusc.	169	Negative	

TABLE I—*Continued*

Herd	Case	Reaction to Tuberculin (Intradermal Test)	Animal Inoculations: Species	Number	Mode of Inoculation	Days after Inoculation	Result	Remarks
11	22 and 23	Suspicious	G. P. G. P.	469 470	Intramusc. Subcu. and intra-abdom.	160 85	Negative Negative	Moderate involvement of skin and muscle from two cows. Large number of acid-fasts found. Preserved in 50 per cent glycerin. Lesions were removed. Animals not slaughtered
5	24	Suspicious	G. P. G. P.	454 455	Intramusc. Subcu. and intra-abdom.	154 90	Negative Negative	Moderate involvement. Few acid-fasts. Animal slaughtered; no other lesions found elsewhere in the body. See case 4, table IV
2	25	Negative	G. P. G. P.	473 474	Subcu. and intra-abdom. Intramusc.	153 74	Negative Negative	Moderate involvement. Animal slaughtered; no other lesions found. Few acid-fasts found
2	26	Negative	G. P. as in case 25. Materials from the two cases combined					Severe involvement. Animal not slaughtered. Few acid-fasts
2	27	Negative	G. P. G. P.	475 476	Intramusc. Intra-abdom.	153 74	Negative Negative	Affected with slight skin lesion. Animal not slaughtered. 29 acid-fasts in 100 fields examined
2	28	Negative	G. P. injections as in case 27. Material from the two cases combined					Severe subcutaneous involvement. Animal not slaughtered
2	29	Negative	G. P. G. P.	477 478	Intra-abdom. and subcu. Intramusc.	153 74	Negative Negative	Slight involvement. Animal not slaughtered. 7 acid-fasts in 100 fields

TABLE I—*Continued*

Herd	Case	Reaction to Tuberculin (Intradermal Test)	Animal Inoculations: Species	Number	Mode of Inoculation	Days after Inoculation	Result	Remarks
2	30	Negative	G. P. injection on same for cases 29 and 31. Materials of the three cases pooled					Moderate subcutaneous lesions at the shoulder joint
2	31	Negative	G. P. injections as in cases 30 and 29					Moderate involvement of inside of left fore leg. Animal not slaughtered. 8 acid-fasts in 100 fields
2	32	Negative	G. P.	479	Intra-abdom. and subcu.	154	Negative	Slight subcutaneous involvement. Animal not slaughtered. No acid-fasts in 100 fields
				480	Intramusc.	74	Negative	
3	33	Reactor	G. P.	551	Subcu.	Still alive		Severe involvement of both front limbs. Mostly subcutaneous; none pierced through the skin. Some have apparently reached the skin. Slaughtered. No other lesions found. Exceedingly large number of acid-fasts singly and in clumps, too numerous to count
			G. P.	552	Intramusc.	Still alive		
			G. P.	553	Intramusc.	70	Negative	
			Rabbit	554	Intrav.	Still alive		
3	34	Reactor	G. P.	555	Intra-abdom. and subcu.	70	Negative	Slight in metacarpal region. Slaughtered. No other lesions found. No acid-fasts found
			G. P.	556	Intramusc.	Still alive		
3	35	Reactor	G. P.	557	Intra-abdom. and subcu.	70	Negative	Moderate involvement in ventral and shoulder region. Subcutaneous, but closely adhering to the skin. Animal slaughtered. No other lesions found
			G. P.	558	Intramusc.	Still alive		

TABLE I—*Continued*

Herd	Case	Reaction to Tuberculin (Intradermal Test)	Animal Inoculations: Species	Number	Mode of Inoculation	Days after Inoculation	Result	Remarks
3	36	Reactor	G. P. injections same as case 35. Material from both cases pooled					Moderate subcutaneous involvement on inside of right hock, adhered closely to the skin. Animal slaughtered. No other lesions found
3	37	Reactor	G. P. injection same as case 34. Materials from both cases used					Slight involvement. Animal slaughtered. No other lesions found
5	38	See remarks	G. P.	559	Subcu. and intramusc.	61	Negative	Severe recent involvement subcutaneously and adhering to skin. At a tuberculin test six months previously, it was clearly negative. Animal not slaughtered. Enormous numbers of acid-fasts. See case 13, table IV
			G. P.	560	Intra-abdom. and subcu.	Still alive		
			G. P.	563	Intra-abdom. and subcu.	Still alive		
			Rabbit	562	Intrav.	Still alive		

proven tubercluous lesions elsewhere in the body. A case, not yet ready to report, is being studied, in which skin lesions and tuberculous-like processes in the mediastinal lymph-node co-existed. Veterinarians in California have reported the occasional finding of skin-lesion cases in which tuberculosis in other parts of the body was also present in the same animal.

Crawford[11] reports fifty-nine cases in which lesions were present in the skin and in other parts of the body simultaneously and 101 in which skin lesions alone were found. Mitchell's[4] report indicates twenty-six cattle in which skin lesions only were present and seven with lesions in the skin and also in other parts of the body.

While in lupus the evidence very strongly indicates that attenuation takes place in a large percentage of the cases, a considerable number appear, however, in which no attenuation has been detected even after residence in the skin for one or more years. Extremely few cases of lupus are on record in which the acid-fasts did not multiply in culture media or produce some lesions in guinea pigs.[12,13] Although the differences between the two diseases are quite definite, they may, in part, be due to the difference in the species of host. Lupus must be accepted as an example of attenuation of tubercle bacilli in the animal body.

Recently a comparison has been made to tuberculides[6] in man. Perard and Ramos[14] suggested that in 1913. Tuberculides seem to be a catch-all for a number of affections of the skin which cannot be properly placed. Gould's *Medical Dictionary* (1928 edition) describes tuberculides as being caused by toxins of tubercle bacilli. As far as can be learned, the principal reason for connecting it with tuberculosis is that it is found in tuberculous people. The lesion, itself, frequently does not show either acid-fasts or evidence of tubercle structure.

Experimentally, there is very little evidence for the correctness of the assumption that tubercle bacilli in or under the skin of animals attenuate or die to such a degree that they cannot be cultivated nor produce lesions in experiment animals.

Crawford[11] failed to produce subcutaneous nodules by the application of guinea pig lesions containing bovine tubercle bacilli to the abraded skin of cattle. He did, however, induce lesions in the local lymph-node and in the mediastinal chain.

Carpenter and Goldberg[9] produced subcutaneous lesions by inoculation of laboratory culture of bovine tubercle bacilli, and

the lesions simulated those found in skin lesions, but they failed to make these tubercle bacilli innocuous for guinea pigs.[15]

Case Report

We have the following case* to submit:

A male calf, born on April 18, 1927, injected in the dewlap on April 22, 1927, with 100 milligrams of B.C.G. vaccine, was, on August 17, 1927, infected by an intravenous injection of 2 milligrams of virulent bovine tubercle bacilli. On March 2, 1928, in the jugular groove, at the point of inoculation, two hard, round, subcutaneous nodules, each about 20 millimeters in diameter, were observed. On April 21, 245 days after the injection of culture of bovine tubercle bacilli, these lesions had increased to three times the size above mentioned. A portion of these was surgically removed and showed a thin-walled abscess, containing buff-colored, glutinous pus, in which acid-fast but no other organisms were found. Three guinea pigs and one rabbit, inoculated with this material, developed severe generalized tuberculosis within two months. The calf remained in good general condition and was butchered on June 21, 309 days after the intravenous infection. A subcutaneous nodule between the left ischial tuberosity and the rectum was found. This was about 50 millimeters in diameter. This lesion produced severe generalized tuberculosis in two guinea pigs. This calf also showed lesions in the bronchial, mesenteric and gastrohepatic lymph-nodes. The infecting injection, on August 17, 1927, was made with a 10-cc syringe. The needle was first introduced into the vein and, after the blood flowed, the syringe was fitted into the needle and the tubercle bacilli thrown into the blood-stream. The number of organisms introduced subcutaneously in this area, under these conditions, must, therefore, have been extremely small. No evidence of attenuation or death of the tubercle bacilli was found here.

If to this definite, but meagre, evidence, we add the large number of cases of subcutaneous injection of cattle with bovine and human and fewer avian tubercle bacilli in culture and tissue emulsion reported by the British[16,17,18] and the various German[19] and other investigators, we must conclude that experimental evidence to prove that the virulent bovine tubercle bacilli rapidly lose their pathogenicity for experiment animals is not yet available. In these experiments, the guinea pigs, inoculated with either local lesion or regional lymph-node, developed generalized tuberculosis within the usual period. The human and avian viruses often produced only local lesions in cattle. These two types of tubercle bacilli in the local subcutaneous lesion were capable of inducing the usual tuberculous lesion in inoculated animals in spite of the fact that the lesions were often small calcareous ones and of several months standing (as high as ten months).

These experiments do suggest that if some or all acid-fasts found in skin lesions which cannot induce tuberculosis in test animals, were originally a bovine variety of tubercle bacilli, they probably entered in an attenuated form and perished there.

*This case is taken from the records of the B. C. G. project of the Veterinary Division, to be published soon.

The findings in leprosy are in many respects similar to those in cattle skin-lesion cases. The artificial cultivation of lepra bacilli has been successful in only very few instances. Transmission of the disease to animals experimentally has thus far failed. The literature shows that 147[20] attempts were made to transmit leprosy experimentally to man. In only one case did the leprosy develop and the circumstances under which this occurred place some doubt on the experimental transmission. These failures in cultivation and transmission have occurred in spite of the large number of the bacilli found in leprous lesions. In respect to the number of organisms found in the lesions, leprosy differs greatly from the cattle skin lesions since, in the latter, the acid-fasts are usually scarce. Recently, however, three cases have come to my notice in which the organisms were very numerous.

The numerous failures to cultivate and failures to transmit leprosy virus are ascribed by Walker[20] to the rapid death of the organisms in the tissues. This may or may not be the explanation of the many failures with cattle skin lesions, but even if it were, it does not necessarily indicate that such organisms were originally bovine tubercle bacilli.

I have compared the skin-lesion cases with farcin du boeuf of cattle, described by Nocard.[21] A streptothrix with acid-fast elements was found by him. He had no difficulty, however, in growing the organism and producing lesions in animals experimentally.

The possibility of some of these cases being due to avian tuberculosis has occurred to others and to me. We are aware of the findings of the Royal British Commission and others in producing local lesions in cattle and hogs by the subcutaneous injection of avian tuberculous viruses. They also succeeded in producing local lesions in mesenteric lymph-nodes of these animals by feeding avian tubercle bacilli. Elder and Lee,[22] of Wyoming, reported the successful production of local lesions in three cattle by subcutaneous injection of avian tubercle bacilli, and these animals reacted to mammalian tuberculin when injected intradermally. In some of our first cases in 1915 and 1916, we obtained a few positive intradermal reactions with avian tuberculin.

That such cases should occur naturally is not only not beyond a possibility, but it would be surprising if they will not be found. However, epizoological studies in the California cases and inoculations there and elsewhere, thus far have failed to incriminate

the avian tubercle bacilli as the inciting cause of cattle skin lesions.

Hypersensitiveness of Skin-Lesion Cases to Tuberculin

In 1919, I called attention to the fact that many of these cases show tuberculin hypersensitiveness. Since then, others have so reported. Most of the cases that have come to the attention of others and to my notice, have been those which have reacted to tuberculin. From a rather limited number of cases upon which an estimate could be made, I suggested at that time that not less than 50 per cent would give positive intradermal tuberculin reactions. Recently, I made a survey of a large number of reacting and non-reacting cattle in five herds in which skin lesion were found, and the results were:

> Total number showing skin lesions..93
> Of these, 25 (27 per cent) gave positive reactions; 17 (18 per cent) were classed as suspicious, and 51 (55 per cent) were negative.

These data indicate that animals affected with skin lesions are not as sensitive to tuberculin as are animals showing similar or less extent of lesions elsewhere in the body, and it has been generally held by veterinarians with experience in testing cattle, that the so-called reactions in these cases are peculiar and not so definite as in animals affected with tuberculous lesions elsewhere in the body. I have, however, seen very pronounced intradermal tuberculin reactions in skin-lesion cases in which no evidence of internal tuberculosis was found.

Hypersensitiveness to tuberculin is a strong supporting argument in favor of the contention that these lesions are caused by bovine tubercle bacilli. However, this is not conclusive, since we know that group skin hypersensitiveness has been demonstrated in acid-fast infections.

Animal Inoculations with Skin Lesions

The number of skin lesions which were injected into guinea pigs, rabbits, chickens or cattle are by no means all recorded in the literature. However, a sufficient number are found for the purposes of this discussion, as shown in table II.

Marsh[25] reported teat and skin lesions caused by acid-fast organisms. Day[4] mentions the successful transmission of disease to one calf and some guinea pigs. He has also had many failures —definite numbers are not given by him. We can safely state

TABLE II.—*Summary of the literature on the inoculation of animals with skin lesions*

REPORTED BY	CASES	NEGATIVE	POSITIVE
Van Es[23]	38	38	0
Beach and Hastings[24]	54	54	0
Crawford[11]	20	20	0
Wright[8]	8	6	2
Mitchell[6]	33	31	2
California cases—approximately (not reported here, but previously found)	50	50	0
Completed (table I, this report)	32	31	1
Totals	235	230	5

that the percentage of successful infection of animals with skin lesions will not be above five, even where injected animals have been kept for periods of five months and over. The successful transmission of the disease to animals is evidence of the existence of skin and subcutaneous tuberculosis in cattle. The surprising thing is that more such cases have not been found. Even if it be granted that 5 per cent of these cases are due to bovine tubercle bacilli, any attempt to place the remaining 95 per cent is beset with great difficulty. The best any of us can do is to state that we believe or think that the causative agent of all or most of these cases belongs to this or that recognized type of tubercle bacilli or to a yet undescribed acid-fast organism.

ACID-FAST ORGANISMS ISOLATED FROM SKIN LESIONS*

In 1919, I reported the cultivation of a rapidly-growing chromogenic acid-fast from a subcutaneous nodule very carefully removed from the first case that came to my attention. On certain media most of the organisms lose their acid-fastness. On other media, their acid-fastness is well retained in a large proportion of the cases.

Guinea pigs, rabbits and chickens have been injected with this culture in large doses and, to date, no definite evidence of tuberculosis has developed. In fact, the original tissue from which this culture was developed was removed from the test-tube with a portion of the growth and injected into two guinea pigs without producing the usual experimental tuberculosis. Soon after the isolation of this organism, two calves were injected subcutaneously and one intravenously with large doses of this

*Day states that, through personal correspondence, he has learned that Dane, of Utah, has isolated an acid-fast from a skin-lesion case. B. A. Beach advised me by letter that he has isolated from lymph-nodes of reactors non-pathogenic acid-fasts.

organism. The latter failed to show any ill-effects of injection, although kept for over a year. Unfortunately, the autopsy record in this case was lost. The two injected locally developed a lesion which, at the end of the month, increased to 50 millimeters in diameter, but never became larger and, at the end of four months, the lesion had practically disappeared.

The isolated organism was readily dissociated by the method described by Petroff, Branch and Steenkan,[26] into smooth and rough variants. Each of these variants was inoculated intramuscularly and intraabdominally into sixteen guinea pigs, in doses varying from 1 to 50 milligrams; into four rabbits in doses of 25 milligrams, subcutaneously and intravenously—and no definite development of typical tuberculosis was observed.

One hundred and fifty milligrams of each of the R and S variants were injected intravenously into two heifers, respectively, and a third heifer was injected in the carpal region of one limb with one variant and in the carpal region of the other limb with the other variant. Only a slight inflammatory local reaction developed in this third heifer, which disappeared soon. The three animals were slaughtered 169 days after inoculation and the heifer injected subcutaneously showed no lesions, either at the point of inoculation or internally. The heifer inoculated with the S variant showed no lesions. The one* inoculated with the R type showed a heavy-walled abscess in the principal lobe of the liver, about 25 millimeters in diameter. Acid-fast organisms were found in this lesion, but no lymph-gland or other involvement was present. Culture and animal injections from this case are thus far negative.

Tests with Culture Filtrate—Preparation "A."

The isolated organism was grown on glycerin beef broth and also upon Sauton's medium in the same manner as tubercle bacilli are grown for the production of tuberculin, and the cultures treated as in the preparation of tuberculin. The finished product possessed the characteristic tuberculin odor, but usually not so marked as in the case of the latter. For convenience of discussion this product will be referred to as preparation "A." Various batches of this were tested on tuberculous and nontuberculous cattle, guinea pigs and chickens. Results of these tests are being reported in detail elsewhere.

*This animal, tested before slaughter with tuberculin and with preparation A, gave a completely negative reaction with tuberculin and a slightly suspicious reaction with preparation A. The two other animals were negative to both tests.

TABLE III.—*Intradermal tests of tuberculous cattle with preparation "A"*

Animals Tested	Results			Remarks
	Positive	Negative	Suspicious	
19	0	18	1	Readings were made at 48 and 96 hours. 133 animals in this herd, tested at this time with tuberculin, showed 72 definite reactors and 61 negatives. Forty-five of the 133 were injected on opposite subcaudal fold at the same time with preparation "A." Nineteen of these happened to have reacted to the tuberculin.
53	0	52	1	Portion of a tuberculous herd, injected at the same time with tuberculin on one fold and preparation A on opposite. Results read at 72 hours.
39	0	34	5	Ten months before this test, all yielded strong positive tuberculin reaction. Of the five classed as suspicious, two might have been called positive; they were hardly 2x. Reading at 72 hours.
42	0	40	2	These animals were tested before slaughter; 5 were read at 46 hours, 18 at 71 hours, 17 at 92 hours, and 2 at 72 and 120 hours. All these showed definite lesions of tuberculosis as proved by guinea pig inoculations. Some were mild, others severe, and most would be classed as well-marked.

The summary of the tests upon cattle contained in tables III and IV shows that:

Seventy-four animals in several tuberculous herds, which gave definite reactions to the intradermal tuberculin test and tested at the same time with the concentrated preparation A, gave clearly negative results in seventy-two cases. In two cattle, an indecisive reaction was produced with this preparation. Twenty-eight of this group were tested with 33 per cent of preparation A. All other tests were made with concentrated (to one-tenth original volume) preparation A.

Thirty-nine cattle, classed as tuberculin reactors in July, 1927, were tested with preparation A ten months later, with the result that thirty-four gave negative reactions, three gave slightly suspicious reactions, and two were questionable and might have been classed as positive by a few.

Forty animals, proved to be tuberculous by autopsy and guinea pig inoculations, were tested within a week of slaughter with

preparation A, and showed thirty-nine definitely negative and one slightly suspicious. The lesions in these animals varied from mild to extensive. The greatest majority, however, would be called well marked.

Six other cattle, showing local B.C.G. vaccination lesions and tested before slaughter, yielded negative results when tested intradermally with this preparation A.

TABLE IV.—*Intradermal tests with preparation "A" upon cattle affected with skin lesions*

Cow	Reactions				Extent of Skin Lesions	
	Tuberculin		Preparation "A"			
	72 Hrs.	120 Hrs.	72 Hrs.	120 Hrs.		
1	S	.S	S	S.	Moderate	
2	+	S.	S.	S	Moderate	
3	+	+.	+	+	Moderate	This case reported in table I as case 20
4	S.	S.	S	.S	Moderate	This case reported in table I as case 24
5	S.	.S	S	.S	Moderate	Lesion removed. Test, 7 months later with preparation A—reaction at 72 hours of .S
6	0	0	+..	0	Moderate	Tested 7 months previously, with S reaction at 72 and 120 hours with tuberculin and preparation A
7	+.	+.	+.	+	Severe	This case reported in table I as case 10
8	S.	S.	S	S	Moderate	This case reported in table I as case 9
9	0	0	.S	0	Moderate	Tested 7 months previously with tuberculin, showed .S at 72 and 120 hours
10	0	0	S.	0	Moderate	Tested 7 months previously with tuberculin and yielded S at 72 hours and .S at 120 hours
11	0	0	+.	0	Moderate	Tested 7 months previously with tuberculin and was negative at 72 and 120 hours
12	0	0	+	0	Moderate	Tested 7 months previously with tuberculin and was negative at 72 and 120 hours
13	0	0	+..	0	Extensive	Tested 7 months previously with tuberculin and was negative at 72 and 120 hours Reported in table I as case 38
14	0	0	.S	0	Extensive	Tested 7 months previously with tuberculin, yielded S at 72 hours and .S at 120 hours

EXPLANATION OF SYMBOLS USED

0 = No test or observation made.
— = Negative.
S = Suspicious reactor.
.S = Less suspicious than S.
S. = More suspicious than S.
\+ = Positive reactor.
+. = Positive reactor, more pronounced than +.
+.. = Positive reactor, more pronounced than +., etc.

It is not assumed that all 159 would have reacted positively to intradermal mammalian tuberculin. Seventy-four, however, actually did react to tuberculin when simultaneously treated with preparation A. Of the remaining eighty-five, a large percentage would, no doubt, have reacted to tuberculin.

The tests upon fourteen skin-lesion cases reported in table III are by far too few to permit of any definite conclusions. In the cases where tuberculin and concentrated preparation A were used simultaneously, there was a general agreement, although the reactions were slightly stronger with tuberculin in some cases. Where preparation A alone was used and the remarks indicate that a previous test with tuberculin was negative, it is not my intention to give the impression that the tuberculin test would have been negative had it been applied at the time the test with

TABLE V.—*Intradermal tests with preparation "A" upon guinea pigs*

Guinea Pigs Sensitized with Acid-Fast Organism Isolated from Skin Lesion		
68 Tests with Preparation "A"	**44 Tests with Intradermal Tuberculin**	**28 Tests with Avian Tuberculin**
Positive.........49	Positive.......... 1	Positive......... 1
*Indecisive.......15	Indecisive........ 5	Indecisive....... 5
Negative........ 4	Negative.........38	Negative........22

Guinea Pigs Sensitized with Tubercle Bacilli in Culture or Tissue Emulsion		
73 Tests with Preparation "A"	**60 Tests with Intradermal Tuberculin**	
Positive.........15	Positive..........56	
Indecisive.......23	Indecisive........ 3	
Negative........35	Negative......... 1	

Guinea Pigs Sensitized with Avian Tubercle Bacilli in Culture or Tissue Emulsion		
32 Tests with Preparation "A"		**31 Tests with Avian Tuberculin**
Positive.........24		Positive.........30
Indecisive....... 6		Indecisive....... 1
Negative........11		Negative........ 0

*The term "indecisive" refers to a reaction where a definite decision as to its being positive or negative was not made. The reaction was either not typical and transient (persisting for less than 36 hours) or it showed a reddening and induration with or without central necrosis, and the whole involving an area between 6 and 9 mm. in diameter, which persisted for 36 or 48 hours.

In all tests, the effect of the injection upon normal and negative control guinea pigs was taken into consideration.

preparation A was made. On the contrary, we have reason to believe that the tuberculin would have given at least as strong a reaction as preparation A induced. Non-tuberculous and no-skin-lesion controls gave negative results. It will be noted that six skin-lesion cases gave positive reactions to preparation A. The others were either very slightly suspicious or fairly so.

In general, the positive reactions were more pronounced with the homologous antigen when more than one antigen was used upon the same animal.

Recapitulation

It is evident that the proper classification of the organisms inducing the skin lesions is essential in order to determine the relation of these lesions to the recognized or perhaps yet unrecognized types of acid-fast infections. When such an attempt is made, we find the evidence too meagre to warrant a definite decision.

Naturally, the finding of acid-fast rods in tuberculous-like lesions in tuberculin-reacting cattle at once suggests bovine tuberculosis. Such a conclusion would have been generally accepted were it not for the fact that the acid-fast organisms, with few exceptions, have not been able to induce experimental tuberculosis in the animals injected with tissue emulsions and also for the fact that culture media sown with skin-lesion tissue containing acid-fasts has thus far failed to support such conclusion. Acid-fast organisms cannot be definitely classified by their morphology or staining reaction. Hypersensitiveness to tuberculin is good supporting evidence that the lesions may be induced by mammalian tubercle bacilli, but even this is not conclusive, since we must recognize the group reactions with acid-fast organisms.

The few successful experimental productions of tuberculosis with these lesions is proof that skin and subcutaneous tuberculosis exist in cattle, but cannot unequivocally be accepted as proof that all the other cases studied (roughly estimated to be 95 per cent) were also induced by bovine tubercle bacilli. There is at present no available experimental evidence to show that bovine tubercle bacilli lose their power to produce lesions and to grow on suitable media soon after they are placed under the skin of cattle.

The few acid-fast organisms isolated from the lesions have thus far failed to answer the present accepted biological standards for

bovine tubercle bacilli. What further studies will develop must be awaited.

The degree of skin hypersensitiveness to preparations from the culture isolated by me and to mammalian tuberculin indicates a very much closer relation of tuberculosis to mammalian tuberculin than to the preparation from the culture isolated, and that a much closer relation exists between this preparation to some skin lesions than to tuberculosis. The same trend was shown in the guinea pig tests. While these conclusions are based on few observations, they deserve some consideration in our endeavors to settle this problem.

The skin-lesion cases give no end of trouble to the men in the field. Cattle reacting to tuberculin should be removed. There is no other alternative. What disposition should be made of a herd in relation to accreditation in which reactors are found with skin lesions and no other evidence of tuberculosis? In what class shall we place animals that react to tuberculin and show skin lesions in which no acid-fasts are found nor are animals infected with lesions from such animals? And, furthermore, what disposition is to be made of an animal and the herd in which it is found when skin lesions are present, but such animal does not react positively to the test? If it is assumed that all these cases are caused by bovine tubercle bacilli, it must be accepted that such an animal is a physical case of bovine tuberculosis but does not react to tuberculin. These and other questions present themselves to veterinarians making tuberculin tests.

Since it is generally accepted that the skin lesions contain dead or avirulent bacilli, it appears that this should be taken into consideration in the classification of animals and determining the status of herds in which definite evidence of tuberculosis in other parts of the body is not found.

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Discussion

Dr. E. A. Watson: I think this question of skin tuberculosis is extremely important, and I should like very much to see some discussion on it, because it is not a question that is solely concerned with skin tuberculosis. It seems to me that it brings up and has an important bearing upon several of the papers read today, the question of the type of bacillus.

It would appear that the time is arriving, if it has not already arrived, when we shall have to modify considerably our conceptions of the present recognized types of tubercle bacilli. We are still operating on a very arbitrary classification, taking it more or less for granted that a certain so-called type has to produce a certain type of lesion in a certain given time in a particular animal species. From what we know of tubercle bacilli now, it would seem almost unreasonable to expect that we should find in nature these tubercle bacilli conforming to one or another of these so-called arbitrarily drawn types.

In the paper just read by Dr. Traum, mention is made that in approximately 5 per cent of these so-called skin cases positive results have been obtained in inoculation of animals. It seems to me to be a much more significant fact that in 5 per cent we have *some* evidence than in the fact that in the other 95 per cent there is *negative* evidence, as positive evidence must always be much more important than negative evidence.

In our own work we have already isolated several strains (I would not say types, but of bacilli) from no-lesion skin cases, and we are definitely of the opinion that they are true tubercle bacilli. We would not say for a moment whether they are bovine in type. As an instance, one strain, inoculated into a large number of rabbits, guinea pigs and chickens at the same time, produced after six months an infection in only one rabbit; subsequent inoculation from that rabbit into chickens and guinea pigs produced in one year pulmonary tuberculosis in the chickens, and subsequently after passage from the chicken produced typical mammalian tuberculosis in guinea pigs. I do not know what type or strain you would call that; it does not conform to any.

The second strain, isolated from skin lesions, inoculated in the same way into guinea pigs, rabbits and chickens, produced progressive tuberculosis at the first passage in only one guinea pig after a three-months period of observation. Subsequent passages have also proved relatively non-pathogenic for rabbits and chickens, and still more pathogenic for guinea pigs, until it is now mortally pathogenic for guinea pigs in 30 to 40 days, apparently of the human type. I mention those two cases only, to show that we are dealing with strains rather than types, and that the difficulty we have now in all our work is to differentiate between types.

It seems to me largely a question of virulence and pathogenicity. We have little right to say that an organism belongs to a certain type because it does not produce, for example, progressive tuberculosis in guinea pigs in the space of two months. From what we know of tuberculous infection duration in men and in animals, in which it is not evidenced clinically in any way at all, in which it may be in a state of rest for unknown periods of time, is it not perfectly logical to consider that we have in nature strains of tubercle bacilli in every type, but very tremendous in their degree of pathogenicity or virulence?

When Dr. Heath was reading all the statistics on transmissibility of bovine infection to man, the tremendous number of statistics based entirely or more or less largely upon whether the guinea pigs and rabbits came down in a certain length of time (the time was not given, but probably in most cases, as is the rule, about two months, which is the period given to guinea pigs to show progressive lesions), I wondered if those guinea pigs had been kept six months or one year, how much greater a number would have shown progressive lesions. I thought at that time that instead of the percentage of cases given being too high, the transmissibility of bovine tuberculosis from animals to man is probably very much higher. Probably there are a great many more strains of those bacilli that are said to be negative for rabbits that would have been positive if they had been kept for a longer time.

I think the whole question of skin tuberculosis has a close relationship to the whole question of the typing or classification of tubercle bacilli. It is really a question of type, which I hope to see elucidated in some way. (Applause)

PRESIDENT CARY: Gentlemen, the next on the program is "Tuberculosis Eradication Campaign," by Mr. A. J. Glover, Editor of Hoard's Dairyman, Fort Atkinson, Wisconsin. (Applause)

TUBERCULOSIS ERADICATION CAMPAIGN

By A. J. GLOVER, *Fort Atkinson, Wis.*

Editor of Hoard's Dairyman

MR. CHAIRMAN AND GENTLEMEN:

At Kansas City the other night I was going up in the elevator and a fellow was in the elevator who had imbibed a little too much corn-juice. He looked at me and he finally said, "You are a devil of a looking fellow."

"Why," I said, "I can't help it; that is the way the Lord made me."

"He may be all right, but you could have stayed at home, couldn't you?" (Laughter) I feel just that way now; I could have stayed away from here because I have been engaged in other work so closely since I have arrived in Chicago that I have scarcely had time to give attention to this old Association with which I have been associated for many years. It is not that I have less interest, but I seem to have more opportunities for using my time.

What I shall say to you today has not been committed to paper, and I am perhaps placing myself in the position of the old darky preacher who spoke extemporaneously. Rastus was out

plowing corn in Virginia with his mule and down came a bolt of lightning and just scattered the mule and Rastus all over the field. The family made up its mind, however, that Rastus was going to have a decent burial and they provided a fine coffin and sent to Richmond, Virginia, for a man who made a specialty of preaching funeral sermons.

This darky preacher went on to tell all the good things that Rastus had done, how much he was loved in his community, and he said, "When the good Lord was willing to call him home, he didn't cause him to lie sick with typhoid fever and suffer for weeks and weeks, nor to meet with an automobile accident and to suffer there and finally pass on. No, sir, he didn't do that. When he wanted Rastus he just done pressed a button and summarized him home." (Laughter)

I may get the wrong word in the wrong place, but it will be with much understanding, I hope, as the old darky's statement that he "summarized Rastus home."

I have been engaged so long in this tuberculosis eradication work and have studied it for so many years that it seems almost like bringing coals to Newcastle to discuss it before you men who have also been giving it close attention. I was thinking the other day of the first test that I made. The first subcutaneous test was made in 1893 and none of us knew very much about it then, but that was the very beginning of the work. From that time to this I have been interested in the eradication of bovine tuberculosis and have done what little I could to help this good work along. As I look back over the early conceptions of this promiscuous testing, I can see now that it was all in the part of evolution. We didn't make much progress by testing a few and throwing them out of the herd, or selling them to our neighbors, or letting them pass into some other state.

I can well remember when Wisconsin was selling all its reacting cattle in another state, because that state said there was nothing to tuberculosis, it was just a white-collared man's way of getting an easy living. They continued until today this same state has had tuberculosis in particular places running up to 50, 60 and 80 per cent in the herds, and some herds have marched away in the last year or two without being tested at all because the man said; "They are all tuberculous." I have seen that tremendous economic loss and that delayed progress because men were blind to the opportunities of cleaning up this scourge.

It is with a great deal of satisfaction that I read of the splendid progress that we have made since we have attacked this disease upon the area plan and the county plan. I remember well, when that plan was being discussed, how American people had misgivings about it. I remember we discussed the tail test and the misgivings we had about that, all of which shows that there is nothing that comes quickly. It requires study, it requires contest, it requires discussion, it requires differences of opinion to make progress.

Yesterday I happened to be elected to an organization that represents the entire dairy industry, a federation of all the varied interests. This conflict and everything the human mind can conceive is of common interest; there is opportunity there to unite in a common purpose, and then by giving and taking we can lessen the friction that is naturally there and always will be there. I said: "Thank God there is a difference within the membership." And I hope there will always continue to be a difference because as soon as there isn't a difference then stagnation sets in and decay follows. I hope there will always be enough difference in this organization to keep us discussing the questions that are constantly coming before us pertaining to our live stock. We have had them in the past, we are having them now, and we will have them in the future; and the more I think about differences the more I welcome them, because that is the way we make progress.

It is simply short of marvelous to look back over the work we have done, from the small beginning about ten years ago, to the testing of over a million head of cattle last year, from an average reaction then of 4.9 per cent to a reaction today of less than 2.5 per cent. We have decreased the numbers of tuberculosis; we are cleaning up some of the worst areas during this period, and yet, it has been receding and receding.

I can see dangers coming. I can immediately comprehend that men will say: "This job is done. We are over the hill and we can relax." I should think that we are now in a dangerous position of getting that mental attitude. While the work is going splendidly, we still have some opposition. As I said to one of my friends before I came in here today, we have just enough opposition to keep us stimulated to do our job and do it well, and I hope there will always be opposition to the eradication of this disease until we have completed the job; otherwise, we will get lax and may not complete the work.

I can look forward into the future and see that we are going to have greater accomplishments than we thought when we started this job on the present plan ten years ago. I think there are some things we should be emphasizing as we do this job. I have always been concerned about the clean-up following the testing of herds. I am glad to see that in some states there are regular crews organized for that purpose which are in charge of a man who understands the cleaning-up of the premises and other disinfecting, because the average man—well, the unusual man I might say—doesn't understand how to clean up, disinfect and destroy this contagion. They picture in their minds that we are simply getting rid of diseased animals. We are destroying the contagion, the thing which causes diseased animals. To do that, it is necessary that the barns and the yards and all other places frequented by cattle should be thoroughly cleaned and thoroughly disinfected, and we cannot over-emphasize the importance of sanitation, because after all is said and done, we know that in this profession sanitation perhaps is the greatest factor for health.

This work has been of tremendous advantage to the dairy industry of which I can speak with some understanding. During the time that we have been conducting this area testing and doing this work upon such a large scale, we have increased the consumption of milk 33 per cent. It was held in the beginning that, if we started out to talk upon the dangers of tuberculosis being passed from animal to man, we would injure the dairy industry. I met that on every side, perhaps more than you people did. But the stubborn fact remains, according to the best statistics the federal government has been able to gather, that the milk consumption during the period of 1916 to 1926 increased 33 per cent. What was back of it? More confidence on the part of the consumer was put into the product that the dairy farmer was selling, and to put the necessary confidence into a product, we must put into a product, in other words, that which cannot be bought or sold and has no commercial value. That is what we have put into the dairy products by this program of tuberculosis eradication, and then the pasteurization of milk and placing upon the market a better quality of product.

I can conceive of going still further into the eradication of animal diseases that will be of help to the live stock industry, but it doesn't seem as though it is necessary for me to discuss them at this time. There may be a time later on this program,

and I think Friday I may bring up another disease that is coming up to bother the dairy industry which we may well consider.

I was asked to say something about my trip to Europe this last year. I can't say very much about that. I went with my wife. If you ever go with your wife you will find you are taken into shops and cathedrals. I never want to see another cathedral. (Laughter) I understand what those places are for; they are places for worship. I am for them, but I don't want to visit any more just for the purpose of seeing them. If you ever go to Europe with your wife and she has a propensity for cathedrals, you will understand what I mean. (Laughter)

I did manage to slip away and get into the pastures over there and visit with a few dairy farmers, especially in Scotland and a few places in Denmark. I talked with them about this subject of tuberculosis eradication. They are in a predicament that we would be in perhaps fifty years from now if we hadn't faced this disease. They have so much tuberculosis that they cannot follow our system of eradicating it. It would simply destroy practically all their live stock in certain sections. They must depend upon pasteurization as a protection for their people, and gradually work their herds into clean herds. That is the situation in many places in Europe, and I wonder if the farmers of this country will ever be grateful to this body of men and to others who have been instrumental in taking hold of the disease before it got to a point where it could not be dealt with on the plan that we are using, that is, burying the contagion.

I also found that it affected the consumption of milk. I attended one meeting in Glasgow where men stood up and pointed out diseases due to malnutrition, improper diet, and so forth. The children and grown-ups were not receiving milk in their diet. Milk has been introduced into the diets of the children at school and marvelous results have been obtained, increased growth, increased height, increased health, glossy eyes, glossy hair, better looking finger nails, and everything that goes to make up a healthy body has been noticed by putting this little bit of milk into the child's diet, by giving them a glass in the morning and a glass in the afternoon.

I saw more children on the streets of Glasgow suffering from rickets than I have ever seen in all my life in America or any other place, and it is due to the fact that there is a tremendous under-consumption of milk in that country.

I was glad to have the opportunity to sit in and listen to those people discuss the necessity of milk in the diet and point out that the people of that city were suffering from malnutrition because they weren't getting milk. I got that from the lips of doctors, from the lips of health officers, men who were in contact with it. So we can see while we study conditions there and as we study conditions back here that this program of eradicating bovine tuberculosis has reached beyond the economics of the farm, but has extended to the health of the people of this country and it will extend to the health of the people of many European nations. That was my observation in those foreign countries. (Applause)

President Cary: We will listen to a report on "A Two-Year Experiment with the 'Calmette' Method of Vaccination," by Dr. W. P. Larson of the University of Minnesota, and Dr. W. A. Evans, of Chicago, Ill. Dr. Larson will give the report. (Applause)

A TWO-YEAR EXPERIMENT WITH THE "CALMETTE" METHOD OF VACCINATION

By W. P. Larson, *Minneapolis, Minn.*

Medical School, University of Minnesota

and

W. A. Evans, *Chicago, Ill.*

Mr. Chairman and Gentlemen:

Some years ago, the eminent French bacteriologist, Calmette, published a set of papers in which he set forth a method of reducing the virulence of the tubercle bacillus. Briefly stated, this consisted of growing the organism on a bile medium, for some 300 generations, occupying a period of twelve or thirteen years. He found that the organism thus treated had lost its power to produce tuberculosis, but he stated that it still possessed the ability to establish itself in the organism of a susceptible animal without actually producing the disease. This work was followed with further work on efforts to immunize with this harmless parasite and Calmette has published several papers in which he claims to have succeeded in immunizing, not only cattle and experiment animals, but children as well, from exposure to tuberculosis.

This work seemed of such importance to the dairy industry of this country that an experiment was planned among Mr. Stannard, Commissioner of Agriculture of the State of Illinois, Dr. Evans and the speaker. We proposed to test out Calmette's

method under farm conditions to see what might be accomplished by this method of vaccination. Dr. Calmette kindly provided us with an authentic culture of B. C. G. So, in the late fall of 1926, the experiment was begun at Springfield, Illinois.

I might say that the Department of Agriculture, under Mr. Stannard, has an experiment farm about four miles from the city of Springfield, in which we could conduct this experiment. The farm is provided with barns and all the equipment necessary. This farm was originally established for the study of hog cholera and the production of anti-hog cholera serum. However, for a period of about ten years, the farm had stood more or less vacant, there having been no cattle on the place for at least nine years, and very few hogs for several years. We, therefore, felt that the farm was clean from the standpoint of tuberculosis.

In the late summer of 1926 we procured 60 head of cattle, from accredited areas in Illinois, where the incidence of tuberculosis was less than 3 per cent. The cattle were obtained from herds known to be free from tuberculosis, but they were tested again by experienced veterinarians before they were accepted on the experiment farm.

Calmette advises the use of calves only, as he states that older animals are not desirable for this experimental work.

The background for Calmette's work was laid by Koch many years ago, in an observation which has since come to be known as the phenomenon of Koch. Briefly stated it is as follows: If we inject a normal animal with an inoculum of tubercle bacilli, we will find a normal, though slow, course of infection which runs for several weeks or several months. If to such an animal, which has recently been inoculated and in which a tuberculous infection is established, we give a second inoculation at some other point of the body, we will find quite a different process. We will have a rapid evolution of the infection to ulceration, extrusion of the inoculum and final healing of the ulcer.

With this picture in mind, Calmette reasoned that we could infect an animal with a non-virulent organism and thus sensitize the tissues, as it were, or, as we say today, establish a state of allergy, and the animal will not absorb a virulent inoculum but will extrude it as we have seen in the Koch phenomenon, and in that way be resistant to the disease. Calmette's theoretical considerations were perfectly sound.

The cattle were 60 in number. They were divided into three groups of twenty each. One group was to serve as the Calmette series; another group was inoculated with a suspension of bacilli which had been killed and suspended in sodium ricinoleate following some of our own observations, and the third group of twenty served as controls on the above two experiment groups. These groups were sub-divided into two sub-groups of ten each. We thought we should determine whether older animals might be immunized, so, at the time of the experiment, we took ten cattle which were from one to three years of age and then ten calves in each group which were less than one week old when the experiment was begun.

On December 3, 1926, the first inoculations were made. We followed Calmette's instructions, inoculating the animals subcutaneously with 100 milligrams of the living culture of B. C. G.

We inoculated the Springfield series with a heavy suspension of killed bacilli, each animal receiving approximately half a gram of the organism based on the dry weight.

The control series was mixed with the other animals, all housed in the same barn, and fed the same feed and mixed in that twenty-acre lot. The animals were fed for the first eighteen months essentially on dry feed, because we wished to have the animals closely confined to give every possible opportunity for exposure.

We deviated from Calmette's instructions in one essential point. Calmette recommended inoculating the animals and following that by immediate exposure. We did not think that was a sound immunologic procedure, so we determined to allow the animals to run for a period of six months before exposing them to tuberculous animals.

The following year, in May, 1927, we turned in ten head of cattle which were reactors and which had been derived from herds known to be badly infected. About the end of the first year we had fifteen head of reactors with our experiment animals. At the end of one year, we renewed the inoculation of the Calmette series, according to Calmette's instruction, again giving them 100 milligrams subcutaneously.

On the other hand, we had originally intended to inoculate the Springfield series every three months during the entire course of the experiment. However, we abandoned that plan at the end of one year, the Springfield series having received four inoculations at four-month intervals. It seemed desirable for various reasons to terminate the experiment about one month ago. On

the seventh of last November, we went to Springfield and had the cattle autopsied.

In order that there may be no question as to the observation of the postmortems, these were conducted by Dr. McGrath and an experienced staff of meat inspectors, and the results which I am reporting are their results, although the examination has tallied in every instance with the microscopic observation.

Before going further, I might say at this time that before we turned in the infected animals at the end of the six-month period, we made a tuberculin test of all the animals in the herd and we found that exactly 50 per cent of the inoculated cattle gave a positive tuberculin reaction, while the other 50 per cent were negative. We felt, therefore, that we should examine some of these cattle to determine whether they were suffering from tuberculosis or whether these reactions were due to the vaccination.

We took one animal from each group. One cow and a calf from the Calmette and one cow and a calf from the Springfield series were killed, just before turning in the infected animals. We found no macroscopic sign of tuberculosis, and macerated glands from these animals, injected into guinea pigs, failed to develop tuberculosis. We felt, therefore, that no tuberculosis had developed in these animals up to the time those tuberculous animals were injected.

At the termination of the experiment, we had nine cows left in the Calmette series. Of these nine cows, eight showed positive tuberculin reactions and one negative, or a percentage of 88.8 per cent positive in our Calmette group.

In the Springfield group we also had nine animals at the end of the experiment. Four were positive, or 44.4 per cent.

Thus we see that in the Springfield series, which were vaccinated with the heavy suspension of killed bacilli, we had half as much tuberculosis as in the Calmette series.

In our control series we lost two of the animals; one was autopsied and one was not. We had eight at the end of the experiment, seven positive and one negative, or 87 per cent incidence of tuberculosis. In other words, the controls and the Calmette cows ran parallel; we had just as much tuberculosis in one as in the other, which seemed to indicate that our experiment was probably pretty well controlled.

Then we took the Calmette calves first. At the end of the experiment we had seven calves left. I might state at this point

that following our vaccination, each time we vaccinated, we lost one calf of the Calmette series with some acute infection which was not very accurately determined. Another calf was injected and introduced into the herd, but at the end of the experiment we had only seven of the Calmette calves, four of which showed tuberculosis, with three negative, or 57 per cent incidence of tuberculosis in the Calmette calves.

Among the Springfield series we had eight calves left at the end of the experiment, only two of which showed tuberculosis, or an incidence of 25 per cent tuberculosis in this series.

In the control series we had only six animals left. It so happened that the Department of Agriculture was pressed for some work on snakeroot poisoning and they took out two of our control calves for that work. That accounts for the fact that we have only six calves for our control experiment. It was unfortunate that we lost those calves. We had only 33 per cent infection among the controls. You see that here again the control calves had less incidence of tuberculosis than the Calmette series.

We do not feel that our series is sufficiently large to warrant the conclusion that the calves may have been infected by the B. C. G. I think the difference in figures is probably due to the fact that the series was not as large as it should have been. We feel, although our work is perhaps not of sufficient magnitude to warrant the conclusion, that perhaps it is necessary to vaccinate against tuberculosis as often as every three months, in order to maintain that state of allergy which I believe is probably not more than of three months' duration.

Before the cattle were killed we performed a tuberculin test on the entire series, but only five of the vaccinated animals of both series, three in the Calmette series and two in the Springfield series, gave a positive tuberculin reaction at that time, which indicates very strongly that the manipulation to which the cattle had been subjected interferes and upsets the value of the tuberculin test.

Our work would seem to indicate that the Calmette method of vaccination has no value whatever in cattle. It seems, from the other series, that we might be justified in carrying out another experiment on a somewhat larger scale, using the killed organisms. If this could be done on a very large scale, we would in that case vaccinate every three months, in the hope that we could maintain this state of allergy. (Applause)

Discussion

President Cary: I see another member of this committee in the house. I would like him to say something if he likes. Dr. W. A. Evans. (Applause)

Dr. Evans: Gentlemen, I don't believe there is anything I can add to what has been said. I want to call your attention to this point, that this experiment was made under farm conditions. I believe it is the only time, on this continent, that this work has been done under conditions as they prevail on the farm. In the other work with this method of vaccination, the tests have been largely those of the laboratory.

There are some reports from Europe of similar work done under farm conditions, but as far as I know, there are none from the United States.

The observation speaks for itself. We merely submit it as some work done, with the results of the work, I believe, to be interpreted by anyone who has an opportunity to study the figures. I think we will have to make more than one repetition of this piece of work. It is a difficult question, a question that will need years for its solution, but I regard this as a valuable contribution toward the study of this difficult question. (Applause)

Mr. A. J. Glover: The report reminds me of an instance which took place before we had serum for the treating of hog cholera. An old fellow was smoking his pipe and a man came along with some powders that would cure hog cholera, and he got the old fellow to buy them. The old fellow fed them to the hogs. A week later the agent came back and the old fellow was again on his porch smoking. He bid the time of day and said: "Uncle, how are your hogs getting along?"

The old farmer said: "They seem to be dying a little easier." (Laughter)

Dr. J. W. Connaway: I want to remind this group, especially that portion of it that did not attend the A. V. M. A. meeting in Minneapolis, that Dr. Watson presented work there somewhat similar to this and with like results. I shall leave it to these two investigators, both of them in America, as to which shall have precedence, but let us go back a little further. In 1904 or 1905, Behring at Marburg was making a substance called bovovaccine. I visited his laboratory and later got some of that material from an agency which had been established in this country to sell it to the veterinarians. I got sufficient to vaccinate ten calves. I followed out Behring's directions and later exposed these to a couple of cows that has reacted to tuberculin, and in the course of three or four years all these cows came down with tuberculosis. Every one was killed and showed gross lesions of that disease. Bovovaccine went out of fashion, although a good many herds in this country for a while were vaccinated.

President Cary: I want to call on Dr. E. A. Watson to make a few statements about the results of his work in Canada.

Dr. Watson: I am not concerned, as Dr. Connaway has mentioned, with the question of precedence. We have been carrying on experiments with the B. C. G. vaccination for approximately five years in Canada, and the results we have reported on, which, as you know, were somewhat along this line, and were more or less unfavorable.*

We are carrying on in this continent a campaign against tuberculosis on lines opposed to vaccination, but I am sure that every one of us who is engaged in research work has no other object than to ascertain the cold truth about the value and safety of B. C. G. vaccination. If it is found efficient and safe and practical, unquestionably it would be a much less costly procedure than that upon which we are now engaged, and I believe all state and governmental officials would be the very first to advocate it. On the other hand, we are trying to unravel, by research work and by experiments such as these, what are the effects which unfortunately appear to be obscured by claims made, not entirely or even largely upon scientific evidence, but upon assertion and speculation, facts that have been hidden by a great deal of propaganda.

I am not going to take up your time by telling you of our experiments which have already been recorded, but I do want to call attention to one or two points in connection with B. C. G. vaccination.

*Vide "Researches on Bacillus-Calmette-Guérin and Experimental Vaccination Against Bovine Tuberculosis," by E. A. Watson, C. W. McIntosh and H. Konst, in the November, 1928, issue of the Journal.

Calmette and Guérin frankly admit that a vaccinated bovine is not protected from infection. As Dr. Pinner said, recently, we have to recognize infection and actual tuberculous disease. The vaccinated animal is not protected against infection. It absorbs infection and it becomes eligible for that unfortunate class of immune carriers which we have to deal with, not only in tuberculosis but in various other diseases. By B. C. G. vaccination we are increasing the number of immune carriers unquestionably, and Calmette and Guérin have admitted to me themselves that such animals are a danger to other animals that are not so vaccinated. Therefore, we would have to vaccinate all the animals in the country, which is even a bigger problem than testing all the animals in the country.

We should, therefore, be increasing the number of the so-called immune carriers. We should be increasing those hidden obscure sources of infection. Further than that, we should be denying ourselves the opportunity of detecting those sources of infection by destroying the value of the tuberculin test. Further than that, we should be perpetuating those reservoirs of infection which it is now our main object to destroy. (Applause)

President Cary: Gentlemen, we should like to open this subject to general discussion, but I think the main points have been brought out as far as the work has gone and unless there is something special to report on the part of someone we shall take up another subject.

Dr. C. E. Cotton: I just want to call attention to the work of the late Dr. Schroeder in this connection. We have been carrying on work in this connection at the Experiment Station for several years and mention was made in Dr. Moore's report of last year that the results are somewhat like this. In that connection I want to refer to Mr. Glover's remark that the animals died easier. Experiments on small animals showed that vaccination did lengthen their lives, that it took them longer to die, but they eventually died. There did seem to be some immunity, but it was not the lasting and strong immunity. It was Dr. Schroeder's opinion that we could never think of using a system of this kind and letting it interfere with our present splendid method of eradicating the disease. The work is still in progress and a few further results have been obtained which are in line with the earlier one.

President Cary: We will change the subject to one of the oldest ones in connection with this organization, one which really called this organization into being. I expect to introduce to you the son of the man who called the original meeting of this organization, at Fort Worth, in 1896, and it was then for no other purpose than to handle the great subject of tick eradication, of which we knew very little or nothing at that time. I want to call on Mr. Richard Kleberg, of the King Ranch Estate, Kingsville, Texas. (Applause)

TICK ERADICATION IN TEXAS

By Richard Kleberg, *Kingsville, Texas*

Mr. President and Gentleman:

It is always a pleasure to meet with a group representative of the line of work in which all of you are engaged. I happen to represent the man who purchases the live stock, and you gentlemen in this instance are my friends, the enemy of live stock diseases.

The eradication of ticks, as your Chairman has told you, is one of the oldest subjects, in fact the first subject that was called to the attention of this Association. Being an old subject, much has been said and much has been learned; however, the work still continues.

The tick, in certain sections where tick eradication has been conducted ever since the organization of this Association and some short time prior thereto, still exists and flourishes in small sections. These are the ticks in which we are interested. We are interested in the tick that now remains in those areas that have already been cleaned up and that constitute the remaining menace to the clean area.

One of the interesting phases of the subject that I have to discuss this afternoon (and I must admit in a way there are few to the average man) is the fact that despite the long period of time that tick eradication has gone on, there is always something new coming up, giving definite evidence, as in the subject just discussed, that much is yet to be learned.

Tick eradication involves two problems. The main problem at present, in this more or less enlightened day, compared to the early days, is the problem of proper enforcement. In countries where tick eradication has been discussed and rediscussed there certainly can be little question that some of those who are obdurate enough to still continue to insist that tick eradication is impossible must be making these contentious statements upon their narrowness, if you please; their education and the surrounding conditions must have definitely proved to them that ere now tick eradication is a possibility. Those gentlemen who read the live stock markets and note the difference in prices of cattle coming from clean areas and cattle coming from dirty areas, must admit that tick eradication is at least an enlightened public policy.

It reminds me very much of a story involving the matter of viewpoint. It seems that an investigation was conducted in one of our prominent educational institutions, brought about by a statement made before the faculty and board that different nationalities had different viewpoints. A test was decided upon, involving the presentation of the same identical subject to men of different nationalities, and the test was conducted by utilizing as exhibits, first, an Englishman, secondly, a Pole, thirdly, a German, fourthly a Frenchman, and fifthly, one of our own rather variegated species known as an American. The subject assigned was one that is commonly known to man generally, certainly to the citizenship represented by each of the gentlemen under test. "The Elephant" was assigned as a topic for discussion and each of the gentlemen was requested, within six months, to bring in

a statement concerning the elephant from his particular viewpoint.

Briefly, the result was this: At the end of six months the Englishman came in with a thin volume with a caption, "Big Game Hunting—The Elephant." The Pole came in with two very scientific volumes and the elephant was discussed by the Pole under this caption: "The Elephant as Related to the Polish Nationalistic Idea." The German turned in six volumes, which he termed, "A Brief Introduction into the Life and Customs of the Greatest of All Pachyderms—The Elephant." The Frenchman wrote a beautiful, colorful volume, small and artistically arranged, and the caption of this volume was "L'Elephant Affaire d'Amour."

The American wasn't in the room at the time these volumes were handed in and he just got in when the last treatise had been handed in. He walked up before the group of gentlemen conducting the experiment and handed a typewritten page, the heading of which was, "Bigger and Better Elephants."

Gentlemen, we have come to a point in the discussion even of old problems in this country where we are not satisfied. We have gone through a transmutation, as it were, in methods in all lines and kinds of human endeavor, and still we are not satisfied, and in so far as the subject which I am to attempt to discuss briefly before you this afternoon is concerned, my remarks concerning tick eradication definitely will be brief. We have come to a point now where necessity on the part of those who have complied with the law renders it absolutely imperative that closer attention and greater interest be displayed in the eradication of the remaining ticks.

In my section of the country it so happened that I, as one of those engaged in the eradication of ticks, may have been peculiarly successful. That section at that time was recognized as possibly the tickiest section in that immediate vicinity. We managed to clean up the ticks on an area involving some 254,000 acres and harboring 34,000 head of live stock, within nine months. We started the eradication in the fall of 1922 and in 1923, under the most rigid inspection during the early summer, we were clean. There remains in the immediate section, where this 254,000 acres lie and in the county known as Kleberg, a clean area completely surrounding this particular section, with one small exception. We have one premise that is still harboring fever ticks.

Below us and still on the estate which I represent as one of the trustees, and within the boundaries of that estate, bounded on three sides by that estate and on the other side by another large ranch, there is an area comprising something like 50,000 acres that refuses to dip. You gentlemen, particularly those from Texas and my section, know that we have laws concerning tick eradication. We do know that if a man does not comply with the law, the law should provide some recourse. Without making any defense of the great American pastime of practicing legal violations by friendly and obvious means, still there has been a law that has existed on the statute books in this country in almost every state in the Union concerning the maintenance of nuisances.

We also have laws concerning the right of the state and federal governments to invade premises and to take them under their control where contagious and infectious diseases abound. We have laws permitting one state to quarantine against another. We have laws establishing what is known as a quarantine line, and guarded by the federal government against the passage of cattle which may not be brought from a tick-infested area without proper inspection and without complying with the federal regulations.

We find, regardless of the present legal status, that there is much still left undone concerning the enforcement of this vital law, vital to those men who are clean, and which is really a law that should be enforced.

The cattle men of Texas are divided on the question of tick eradication; the vast majority being already clean are, of course, for it in a more or less negative way. The minority, those who are infested with ticks, have certain leaders who come before our State Legislature and constantly and consistently muddy the water when any question is brought before the Appropriations Committee of either the House or Senate concerning the support and maintenance of the State Live Stock Sanitary Commission.

It has been my personal, painful duty for the past four years to appear before each of those committees in an effort to support and to keep going the work of tick eradication, and together with that, the protective work of the Live Stock Sanitary Commission in an effort to prevent the re-infection of already clean premises.

This Association and its interest in this matter is one of the real important items to me. I know that every man in this room is qualified in his particular line of work. I know that his interest

in his line of work is keen, or he certainly would not remain in it. I happen to have the utmost sympathy for the man who is misguided enough to be either a cowpuncher or a veterinarian by choice. (Laughter) I happen to be and you gentlemen happen to belong to the other side. I am not talking about anybody in particular, but I do know that the job, if you attend to it, is a hard one, and I do know that it is to your interest and certainly to mine that you gentlemen collectively set about a program which will provide you with bigger, better and quicker methods for the eradication of ticks. We on our side of the question will attempt to devise ways and means of strengthening the law and giving you our support.

The matter in which you can have some force as I see it and the matter in which you should be interested should be the fostering of a greater and closer research into the present method of eradicating ticks and the possibility of improving thereupon; and in addition thereto a definite effort, based upon a federal appropriation, to the end that something more be learned about our friend, the tick.

There are some things that even those of us who have been engaged in this work for a long time (I don't happen to have shared the burden of years that many of the men who have been engaged in tick eradication now carry) don't know. It happened to be my privilege, way back there, to at least strike my particular individual blow toward sounding the death knell of our fever tick. I happened as a kid to drive nails in the first dipping-vat that was known, the first one built for the purpose of exterminating ticks. When I came back from college (I was educated for a lawyer, only partially as the case may be) I took up the work of seeing that those cows went through that vat, not for the purpose of eradicating the tick, but for the purpose of preventing the tick from killing the cattle with fever by numerical attack. A great many of the cattle men can't conceive of ticks being so bad in a section that where cattle no longer fever, the ticks will kill them, but that is a fact. We dipped for many years before we undertook eradication merely for the purpose of relieving our live stock from the ravages of countless millions of ticks that existed in that country. When you consider the study of the tick from the angle of learning something more about him, let me give you briefly two little instances that may not have occurred to you definitely even though engaged in tick eradication.

One of the instances I have reference to is one that any man engaged in the detection of an offense or in tracing down anything would certainly be interested in. Within a country extending for twenty miles in every direction, entirely clean and after this tick premise had been declared clean and had been clean for eight or nine months, in a small dairy herd on an acreage of a little less than 160 acres, ticks were found. This dairy herd was bounded on one side by a railroad track, with right-of-way fences on both sides, and then a state highway with boundary fences on both sides. On the other two exposures it was bounded by public roads that were utilized in their entirety by automobiles. I was called in by the inspector in charge of the work down there (knowing my interest in it) to attempt to trace down with him where this tick infection had come from. I made a statement which I thought was particularly bright for me. I asked him where the closest ticks were and he told me twenty miles away, on one of these premises which I have already mentioned to you. I asked him the name of the fellow who owns this dairy herd. He said that he was a renter, a Mexican by the name of Antonio Rodregas. When he told me that, my knowledge of the cow-punchers and the laborers in that immediate section, most of them having originated on the King Ranch, told me definitely how those ticks came there. I wrote a letter to him that night and on the following Saturday I told him I would present the letter to him and go out and show him where the ticks came from.

It so happend this man Antonio Rodregas married a young lady by the name of Mendiquez. Her brothers were the best cow hands, and particularly the best brush hands, in that whole section of the country. One of them had been employed by this neighbor who persisted in raising a few thin cattle and many thousand ticks. He had been employed for the purpose of gathering enough cattle to bring to the pens, dip and ship out to market. He had to have a little money and he got dashed little for them anyhow. This man had his clothes washed by the Mendiquez lady who was married to Rodregas. He rode over on Saturday evenings to get his clothes and then he would ride back again on Sunday. We got there Saturday, according to my agreement. We found the horse tied to the tree next to the water-trough in the shade. We found not one but several hundred fever ticks on this horse. Having been ridden by a Mexican for twenty miles his blood had become heated and the ticks were planted for a regular tick hatchery right where every cow had to come to drink

and where every old lazy dairy cow would lie in the shade. The mystery was solved.

Another instance seems to be still more far-fetched. By accident, in 1921, I happened to clean up an area personally, involving two pastures and a small section fenced in and known as a trap, through which a waterway ran. It was only a waterway in case of enormous rains. In other words, it was merely a flat. I cleaned these pastures up; one of the large pastures contained 40,000 acres and the other contained 50,000. The 40,000-acre pasture was used for the purpose of weaning heifer yearlings. Each year the yearling heifers from the entire 254,000 acres were gathered together where they were put out for breeding heifers as two-year-olds.

We had a long drouth of about eighteen months' duration. I found that the cattle that were brought in were very ticky, and in order to protect them and give them a chance because this pasture had lain dormant for several years and had quite a bit of dry grass in it, I found it would be wise to dip these cattle and relieve them of the ticks which they were carrying. I gave orders to the chuck-wagon boys to go down there and dip those cattle every twelve days. I had expected to give them a couple of dippings, possibly three at the most, and be through with them. I was called away to St. Louis. By the time I came back I found that he had dipped those cattle through the latter part of August, September, October and November, every twelve days, and he had dipped the cows in both pastures. One was a breeding herd and the other was a pasture in which the young heifers were kept. I thought nothing of that. We went on about other work. These cattle went out as two-year-olds and the following fall we put yearling heifers back into that pasture. When we put the heifers back into the pasture, there came one of those south Texas rains. They don't come often but when they do come you remember them. It set in to rain and it rained for eighteen hours and the rainfall measured from a half to three-quarters of an inch every hour for that eighteen-hour period. The cows' pasture was bounded by a lake two and one-half miles wide by three miles long. The spillway which brings in the water to this lake crosses the pasture where the heifers were kept and it came from a territory where no tick eradication work had been done except for the purpose of holding ticks down. That place at that time was very ticky.

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We had a gang of Mexicans cutting posts, and in order to cut posts in the mesquite thicket you cut the trees down first, then cut the limbs off and then stand the posts on end. The heaviest timber is close to where the last water is found, in other words, the lower places. This timber was close to one of the old watering-places. They had placed the camp there, had cut down the trees and cut the posts and then stacked them.

I was at home when a ranch man came in with his horse all in a lather and he said, "Mr. Kleberg, the cows are dying like flies."

I went out there in a hurry and found not one but forty or fifty definite cases of Texas fever. The fortunate part was that in this tick-breeding pasture that had been cleaned at the same time and which I had no knowledge of cleaning, we used a specific earmark differentiating the heifer yearlings from every other heifer in the pasture. Every one of the cattle that had fevered bore that earmark. I realized that those calves had never had a tick on them or they would not have fevered. I still couldn't see what that had to do with those pastures. I thought that perhaps I had better check up on the breeding pasture where no rider was located. I went over there and found a whole bunch of yearling steers in the same condition as the yearling heifers. They were really fevered and I found quite a bunch of them dead. We went to dipping immediately.

During the round-up I found where the ticks came from. I found about thirty fence-posts along the edge of this great fresh water basin, that had floated down across this country. These posts had been stacked up on end and you know the habits of ticks. When a tick hatches he will climb up the first thing he gets to, on the shady side. These posts came down in the fresh water together with the axe-chips and I knew where the posts had come from.

Only a few days had elapsed, figuratively speaking; a little less than eight weeks, to be exact. I went over to these pastures and found some of the piles of posts and checked them and found the ticks still upon the posts in small spots, some on edges of the bark hanging there in groups. We had an infection there from what would almost seem an impossibility.

We had another instance of infection from a territory that was cleaned by evacuation and 3500 head from this area showed ticks. There were only two ways for ticks to have gotten into that pasture. The fever tick had possibly crawled onto a buck or doe deer and had fallen off, hatched and gotten onto the cattle and

rehatched and there was some animal in that particular pasture at the time that was carrying the virus of the fever in order to give these cattle the fever.

I merely mention these instances, gentlemen, to call your attention to the necessity, from your viewpoint, in my estimation, of calling upon our department for a still closer investigation and greater research into the life and habits of the tick. Everybody here knows all about the female tick up to a certain extent. They also know something about the male tick. I doubt if there is a man here who can tell me, within any reasonable limit, the actual time when the female tick attains the age of puberty. The same thing may be true concerning the male tick. There may be methods of tick eradication based on climatic conditions, where in most instances they can be taken advantage of, where ticks exist today where the period of ticking can be shortened.

I am here today, my friends, merely to recount to you some of the experiences of a cow-puncher, who has dipped a lot of ticks, and to tell you that, in so far as my own personal study of about seventeen years regarding the ticks is concerned, I still don't know anything about them. I have a bunch of very good friends, men who have taught me a lot, men whom we have relied upon. Dr. Ramsay over there has done a wonderful piece of work and Dr. Connaway, back in the days when father became interested in the tick. I had a long chat with Dr. Connaway last evening. He agreed with me, strange to say. I thought I was possibly the only man crazy enough to think that the veterinarian didn't know enough about ticks.

I certainly would appreciate the fact if anything I have said to you today may have awakened a keener interest and that I may have taken the other side of the question to create an argument to insist that more be known about the tick to guarantee and pledge to you my individual support and the support of those men who are already clean in the continuance of applied effort to see that we finally fix the boundary line of the fever tick, in so far as his present habitat is concerned, along the shores of the Rio Grande on this side and the Gulf of Mexico and the Atlantic on the other side.

When you come to this country of ours and see the lack of attention that is paid to our laws, it reminds me of one funny story. I am going to tell you this and then say goodbye to you. An Englishman came to one of our American hotels and in line with my rather indelicate suggestion that Americans practice the

violation of the law, he went to his room. It was a beautiful room with flowing ice water, and he sat down and took off his coat, put his feet up on the bed and called for a bellboy. The boy came up. He said, "Boy, bring me a whiskey and soda."

The boy looked at him a minute and said, "I can't do that, sir. It is against the law."

He said, "All right. Bring me a straight whiskey in a bottle."

The boy said, "All right, sir." (Applause)

PRESIDENT CARY: The next paper is by Dr. S. J. Horne, Inspector-in-Charge of Tick Eradication, Jackson, Mississippi, who will speak on "The Unfinished Work of Tick Eradication." (Applause)

. . . Dr. Horne read his paper. . . .

THE UNFINISHED WORK OF TICK ERADICATION

By S. J. HORNE, *Jackson, Miss.*

B. A. I. Inspector-in-Charge, Tick Eradication

In discussing this subject it is somewhat hard to determine just what should be said, as this particular work involves quite a large area in several states and exists for several reasons. Therefore, I am not going to say much about why we still have tick infestation, but will confine my remarks to the things necessary to accomplish tick eradication.

Infested territory now is mostly confined to the coastal area, where climatic conditions are ideal for ticks to propagate the entire year, thereby greatly increasing the degree of infestation and involving all cattle, horses and mules in the area, and sometimes infesting sheep and possibly goats.

This condition must be considered and necessarily requires different methods and more efficient and thorough work than was required at the beginning of tick eradication on the original quarantine line.

The essential things necessary to complete tick eradication are as follows:

State legislation.

State appropriations.

Dipping all tick-carrying animals every fourteen days.

Bureau and state cooperation and organization.

The state law should eliminate county officials as much as possible, to get away from local politics, and should designate some one official to administer the law with full authority to enforce strict quarantine, to regulate movements within the state,

to promulgate and enforce rules and regulations governing details and emergencies as they arise, to appoint inspectors and range-riders, and to provide for paint-marking and seizure of all undipped animals.

The rigid enforcement of quarantines prohibiting the movement of cattle, horses and mules from the inactive quarantined areas will prevent reinfestation of free areas and ultimately result in favorable action upon the cattle-owners for tick eradication. Better results and quicker action can be had in enforcing quarantine restrictions, if designated dipping stations are restricted to not more than one station to each state.

Paint-marking is for identification and makes it possible for range-riders to do efficient work in locating all animals that have not been properly dipped.

The seizure of all animals not dipped has many advantages over court procedures. First of all, it gets the animal dipped regularly and permits eradication to progress without interruption. Next, seizures have a very influential effect upon luke-warm owners, causing many to dip regularly who would not if they knew the only recourse were in their local courts. Court procedures are often delayed indefinitely, permitting the objectors to continue to raise ticks and infest others. This causes our friends to become discouraged and often object to dipping because they cannot see any end to the job.

The seizure clause in state laws has resulted in many counties completing tick eradication work before court cases ever were called for trial.

Paint-marking, range-riding and seizure has increased efficiency 100 per cent.

Horses and mules are a great factor in tick eradication. In nine counties in Mississippi doing systematic dipping, during October and November, 82 per cent of all infestation was on horses and mules. Therefore, the law must provide for their dipping the same as cattle, when necessary. Experience has convinced me that the burden should be placed on the owners of horses and mules because dipping these animals is a rather delicate subject. Reports from the field show only about 10 per cent of horses and mules are tick-infested and the public as a whole bitterly resents the requirements to dip all these animals. They insist upon spraying, washing and almost every other method except dipping. Therefore, we tell them that they have the privilege of using any method they choose for keeping their

horses free of ticks, as long as it is effective, but the animals must be brought to the vat for inspection every two weeks and if their methods fail or if ticks are found, the animal must be dipped. This procedure eliminates most of their argument and gets beneficial results.

Tick eradication should be financed by the state in order to remove the work as far as possible from local politics and to permit the work to be taken up consecutively, county after county, and not permit indolent counties to break the line of progress and harbor ticks within a working or free area.

If any part of the expense is to be borne by counties, their duties should be clearly defined in the law, and the state officials should have full authority to require their compliance.

All appointments of state inspectors and range-riders should be made by the state officer and not by the county officials.

Bureau and State Cooperation

The whole-hearted cooperation between Bureau and state officials must exist if satisfactory results are to be had. Nothing to my mind furnishes a more fertile field for ticks to breed and disseminate than does dissension between the above officials. There is nothing that will overcome opposition from live stock owners or strengthen weak laws more than thorough organization and close cooperation of these two departments.

Proper organization is impossible without cooperation. Therefore, it is very essential that an understanding be had between the two by studying the requirements of both departments and harmonizing state with federal or rather strengthening one with the other.

Best results are obtained where the two get together, discuss all major subjects and agree upon the best procedure, then go to the field and before the organization and public with the same idea and purpose.

President Cary: The next speaker was inadvertently left off the printed program. We will call on him now. Dr. R. E. Jackson, of Birmingham, Alabama, will now talk to you on "Some Methods of Tick Eradication." (Applause)

. . . Dr. Jackson read his paper. . . .

ORGANIZATION IN CONNECTION WITH TICK ERADICATION

By R. E. Jackson, *Birmingham, Ala.*

B. A. I. Inspector-in-Charge, Tick Eradication

1. Bureau of Animal Industry and state cooperative agreement.
2. Cooperative agreement of the work thereunder by B. A. I.

inspector-in-charge and the state veterinarian under state laws and regulations.
3. Cooperation key-note of success, based on mutual confidence and adequate law.
4. Preparing a county for work.
5. Assignment of suitable supervising inspector and attending responsibility.
6. (a) Appointment of inspectors.
   (b) Vat inspectors and duties.
   (c) Range-riders and duties.
7. Keeping of records.
8. General supervision.

It should be understood that the basis of a tick eradication organization as conducted today is the cooperative agreement between the Bureau of Animal Industry and the proper state authority, which is usually headed by the state veterinarian. There is set forth in this cooperative agreement the part that each is to take in the work. It should be understood that this work is done under state laws and regulations aided of course by acts of Congress and regulations promulgated thereunder in controlling interstate movements.

Under this cooperative agreement the Bureau of Animal Industry inspector-in-charge assigned and the leading state official (usually the state veterinarian) plan and put into effect the work under such state laws as are available. What I have to say should be taken to apply to the work as conducted in Alabama, though I think it is conducted similarly in other states where tick infestation exists.

Strict cooperation is the key-note of success in our organization of this work, based on mutual confidence and adequate law. Such cooperation in a state must be headed by the Bureau inspector-in-charge and the state veterinarian. If they cannot agree and back up each other, how can it be expected that those who are engaged in the work under their direction will agree, or be properly governed in their work? It must be remembered that discord is the object and would be the delight of our enemies and those opposing our work if accomplished. Many times has its promotion been attempted in Alabama and as many times has it failed.

Under Alabama law it is a duty of the State Veterinarian to present his demand to county boards of commissioners, that they provide for tick eradication work. He designates the things that must be done by the county, such as to furnish the number of

vats specified by him, the chemicals necessary to charge them and keep them charged; the paint for marking cattle, and the number of county inspectors that they must provide. These county inspectors, working under a supervising Bureau inspector, direct the vat construction which is now done generally by county road gangs or outfits gotten up for the purpose. In order that dipping-vats may be safe for the dipping of horses and mules as well as cattle we have learned to be more insistent than formerly, that they be properly constructed to begin with, to avoid valid complaints of stock-owners against their later use. To attain this end an experienced supervisor is necessary.

The selection of a suitable supervising inspector is a most important link in our organization. There are many things to be considered. One man may make a good supervising inspector for one county and be quite unsuitable for another. The state veterinarian and Bureau inspector-in-charge must carefully consider and agree in this matter. It is seldom that an inspector is sufficiently adaptable that he will be suitable in any county. (Note Winston County.) A conscientious state veterinarian is as vitally concerned in this selection as an inspector-in-charge could be, because the work is done under state law largely, which he was instrumental in obtaining, because its application is on live stock owners to whom he feels responsible and who, together with county officials, look askance towards him if things fail to work out under it with reasonable justice and facility, and because it is necessary in the interest of close organization that the supervising inspector must recommend to the state veterinarian the men who are to be commissioned by the state veterinarian and paid by the state or county and likewise must he recommend the termination of those who prove unsuitable and there are many such. The supervising inspector must be saddled with this authority of virtually hiring and firing the men whose work he directs, else there could be but a loose, ineffective organization. Considering these matters and the further fact that he must be satisfactory to cooperating county authorities, it will appear clear to you why a supervising inspector for a given county must be carefully selected.

Now that we have the necessary number of vats constructed, filled with water, the inspectors commissioned and the date of beginning published or given by notices, the dipping of cattle, horses and mules begins. There are between 35 and 40 inspectors for a county of 1000 square miles. They are congregated in one

corner of the county, let us say the northwest corner, and dip at about twelve vats in a more or less rectangular block, depending on the shape of the county. The following day the whole bunch advances east, if the county is longer north and south, and takes in another block of the same number of vats and so on until the eastern border of the county is reached. Then they drop south and start westward and so proceed until they complete one round of dipping. If two adjoining counties are to work, the dipping begins in adjoining corners of each, so that in both of them twenty-four adjoining vats would be in use as the dipping crews proceed east side by side.

On the first round, two or three inspectors are engaged at each vat because the number each owner has must be carefully checked and a card record made on the spot for each herd. Each animal must be paint-marked at a place designated by the supervising inspector and a permit issued for use of range if desired. After the first round the record is easy to follow and usually but one inspector is detailed at each vat. The most of the remainder are spread out one or two days behind the dipping men, to search for any cattle, horses and mules that do not carry the last paint-mark. When any such cattle are found, they are captured and are hauled or driven to a central pound-pen, dipped, officially strayed and held for sale, all cost being charged against the animals. Any balance goes into the county treasury for tick eradication purposes. This procedure soon reduces the number of strays whose owner can not be found. If the owner claims stray cattle, a warrant is obtained for his use of the range without a permit.

The reason for this arrangement of vats in blocks is that the work can be more thoroughly supervised and also the range-riders. A supervising inspector, with this arrangement, can visit all or nearly all of his vat inspectors each day if necessary. When an area is worked in this manner it is far more difficult for an owner of the pet cow or horse or calf to breed ticks for the ensuing year. The dipping is usually accomplished by noon, leaving the afternoon for the county supervisor to look after his range-riders.

It is required of all inspectors that reports be rendered daily and forwarded to the supervising inspector, who maintains an office at the county seat with a clerk to keep a record of each individual herd-owner, as is done by the vat inspector for each herd at his individual vats. All reports showing any irregularities in the

number dipped are held for the attention of the supervising inspector, who assigns them to special range-riders or an assistant for investigation and any action indicated.

A general supervising inspector must visit and travel over each county with the supervising inspector, once or twice each month, to observe if the solution in vats is kept up at proper strength and that paint-marks are being applied in such a manner that they stick. With paint properly applied after animals have shed their winter coat, the marks should remain for two months. The supervising inspector must also look over the records to see that all delinquencies are being corrected.

From time to time the inspector-in-charge, accompanied by the state veterinarian, must go over this area to keep familiar with the situation and see that the work is progressing properly in all of its phases. They must call on the county judge to learn his views or hear any complaints so that any misunderstandings may be corrected if possible and that the results of any prosecution proceedings necessary may be favorable. It sometimes occurs that the most prominent attorneys in a county, if they are properly interested, will refuse to defend those who fail to dip their cattle. When it occurs that the state veterinarian is unable to accompany the inspector-in-charge on his inspection trips, it is necessary that frequent conferences be had in order that he may be kept informed as to the progress being made and concerning all difficulties that appear. He is thereby enabled to better meet all criticisms and objections that appear.

This is cooperative organization and means tick eradication in Alabama.

President Cary: Gentlemen, we will next listen to the report of the Committee on Tick Eradication.

. . . Dr. N. F. Williams read the report. . . .

REPORT OF COMMITTEE ON TICK ERADICATION

Dr. N. F. Williams, *Chairman*, Fort Worth, Texas.

Dr. J. V. Knapp, Tallahassee, Fla.
Dr. R. A. Ramsay, Washington, D. C.
Dr. J. H. Bux, Little Rock, Ark.
Dr. R. V. Rafnel, Jackson, Miss.
Dr. R. E. Jackson, Birmingham, Ala.
Dr. J. M. Sutton, Atlanta, Ga.

A review of the year's activities indicates that this project continues to make satisfactory progress and that the fever tick is gradually but surely being pushed back and completely eliminated in large areas where it has long held sway. The area quarantined because of tick infestation was reduced by 21,537 square miles this year, and is today less than one-fourth that held under this embargo when the work was undertaken in 1906.

The prohibition of the interstate movement of tick-infested cattle for any purpose has long been advocated by this association, and it is gratifying to report that this was finally accomplished on May 1, 1928, when the provisions

of the Crisp Bill became effective. The predictions made by a few cattle interests of the quarantined area, when the passage of this law was under consideration, that its provisions would prove ruinous to the quarantined area have not materialized, and while this law has been in force but a short time it is apparent that the industry is rapidly adjusting itself to the new conditions and that cattle-owners of the quarantined area are finding it not only practicable but profitable to ship tick-free cattle only.

The year's work by cooperating agencies made the following modifications of the federal quarantined area advisable and these changes were made by the Secretary of Agriculture, in B. A. I. Order 312, effective December 1, 1928:

In Alabama: Choctaw, Mobile, and Washington counties are released from quarantine.

In Arkansas: Grant and the remainder of Little River counties are released from quarantine.

In Florida: Dixie, Hamilton, Jefferson, Lafayette, Leon, Madison, Taylor, and Wakulla counties are released from quarantine.

In Louisiana: Assumption, West Baton Rouge, and a portion of Ascension parishes are released from quarantine.

In Oklahoma: McCurtain, and the remainder of LeFlore, Choctaw, and Pushamataha counties are released from quarantine.

In Texas: Bexar, Bowie, Burnet, Karnes, Lampasas, Lavaca, Wilson, and Zavalla counties are released from quarantine.

The existing quarantine of areas in the state of Mississippi and the territory of Porto Rico is continued.

UNITED STATES DEPARTMENT OF AGRICULTURE
Bureau of Animal Industry
Washington, D. C.

Progress in Tick Eradication—July 1, 1906, to December 1, 1928

State	Counties Quarantined July 1, 1906	Counties Quarantined Dec. 1, 1928		Counties Released to Dec. 1, 1928		Area Quarantined July 1, 1906 (Sq. Mi.)	Area Quarantined Dec. 1, 1928 (Sq. Mi.)	Area Released to Dec. 1, 1928	
		Whole	Part	Whole	Part			Sq. Mi.	%
Alabama	67	1	0	66	0	51,279	1,226	50,053	98
Arkansas	75	18	2	55	2	52,525	13,675	38,850	74
California	15	0	0	15	0	79,924	0	79,924	100
Florida	67	41	0	26	0	54,861	32,984	21,877	40
Georgia	158	0	0	158	0	57,438	0	57,438	100
Kentucky	2	0	0	2	0	841	0	841	100
Louisiana	64	38	3	23	3	45,409	31,998	13,411	29
Mississippi	82	23	0	59	0	46,361	13,199	33,163	72
Missouri	4	0	0	4	0	1,386	0	1,386	100
North Carolina	73	0	0	73	0	37,365	0	37,365	100
Oklahoma	61	0	0	61	0	47,890	0	47,890	100
South Carolina	46	0	0	46	0	30,495	0	30,495	100
Tennessee	42	0	0	42	0	16,987	0	16,987	100
Texas	198	70	2	126	2	191,885	67,745	124,140	65
Virginia	31	0	0	31	0	13,918	0	13,918	100
Totals	985	191	7	787	7	728,565	160,827	567,738	78

Area released December 1, 1928, amounted to 21,537 square miles.
No area requarantined December 1, 1928.
(Area released during both calendar and fiscal year 1928 is the same. No requarantine during this period.

During the year, 24 counties were added to the list of released counties reported absolutely tick-free, making a total of 677 counties in the released area in which tick eradication is completed. The Bureau of Animal Industry statement of results to December 1, 1928, in this project is appended for the Association's records.

. . . It was duly moved, seconded and carried that the report be adopted. . . .

PRESIDENT CARY: This question of tick eradication is now open for general discussion.

DR. GEORGE W. STILES: Just a word in connection with the investigation during the past year with reference to the possibility of ticks other than Texas fever ticks being implicated as carriers in anaplasmosis. If my information is correct, our men now engaged in tick eradication have been largely concerned with the identification of the Texas fever tick as against any other variety. If it were Texas fever, they proceeded in a definite manner as outlined; otherwise, the incident was forgotten.

There is some evidence today in foreign lands and a possibility in our own country that ticks other than Texas fever ticks may be implicated in this other disease—anaplasmosis. It is my plea, which I have not yet taken up with Dr. Ramsay or the federal folks, that a closer survey be made, particularly as to distribution, and knowledge gained as to the classification and perhaps more of the life habits of these other ticks found in territory particularly free from Texas fever, by those engaged in this investigation, to consider and gather information along those lines, as it may be of infinite value to us in the future. We have the machinery, federal and state, to carry on such investigations, but we should enlarge it and not overlook the other activity in our investigations of the Texas variety.

DR. W. M. MACKELLAR: What is your idea? Merely to get the location of the infestation by various species of ticks?

DR. STILES: That was one idea which I had in mind. For instance, the Ixodes variety has been found to transmit the disease experimentally. That tick has been found mostly in infested areas in southern Kansas. It has no relation to Texas fever tick and may be of value to us. I feel that we should not overlook the opportunity in view of the organization and facilities we now have instead of waiting five years or some other time to gather information. The state institutions in the two states in which I am working have very scant information from their entomological departments.

DR. MACKELLAR: I might say in explanation that in our tick eradication field offices, while we have no definite record of the location of all such infestation, that is, no farm record, in a general way we could point you to sections infected with the Ixodes tick and several of those more common varieties with just a little research.

. . . The meeting adjourned at 4:50 p. m. . . . .

ADJOURNMENT.

FRIDAY MORNING, DECEMBER 7, 1928

The fifth session covened at 9:15 a. m., President Cary presiding.

PRESIDENT CARY: We shall take up a new subject this morning. I think it is one of the most important parts of our program and I hope you will all give due attention.

The first paper is "The Relation of Undulant Fever to Live Stock Sanitation in the United States," by Dean V. A. Moore, of Cornell University. (Applause)

. . . Dean Moore read his paper. . . .

RELATION OF UNDULANT FEVER IN MAN TO LIVE STOCK SANITATION

By VERANUS A. MOORE, *Ithaca, N. Y.*

Dean, N. Y. State Veterinary College, at Cornell University

For the third time, in less than a half-century, health officials have recognized the transmission to the human family of the etiological factor of a serious and economically important disease of ruminants. The first was bovine tubercle bacillus, which causes in man lesions resembling those it produces in cattle. The second was *Micrococcus melitensis*, transmitted to man from goats and resulting in Malta fever. The third was *Brucella abortus*, the cause of Bang abortion disease in cattle, which incites an entirely different disease in man from the one it engenders in the bovine species. The manifestations of *Brucella abortus* in cattle are, in the female, abortion and its sequelae, and in the male, occasionally tissue necroses in the generative organs.

The disease produced by the Bang abortion organism in man is very similar to that of Malta fever, and has been likened to it. In fact, the term "undulant fever" is a synonym* for Malta fever, but more recently this term has been used by numerous writers to designate the syndrome in man caused by *Br. abortus*. This infection is easily mistaken in its early stages for atypical typhoid fever and, later in its course, it has been diagnosed as malaria and miliary tuberculosis. It is not strange, therefore, that the relationship between abortion in cattle and "undulant fever" in man was not recognized immediately.

When the medical professions were confronted with an analogous situation in bovine tuberculosis, public health officials recognized the problem as being possessed of two parts, the protection of milk-consumers and the control of the disease in cattle. The health officers in cities became responsible for safeguarding the public either through regulations requiring the milk to come from tuberculosis-free cattle, or that it should be pasteurized. The live stock sanitary authorities were charged with the eradication of the disease from cattle. Much progress has been made by both of these agencies.

Health officers found that pasteurization of milk, not only protected children against tuberculosis, but also lessened mate-

*Given by Bruce in his work on Malta fever.

rially epidemics of typhoid fever, diphtheria and other milk-borne diseases. Dairymen discovered that when tuberculosis was eliminated from otherwise healthy herds, production increased and the health of the cattle generally was improved. The practical outcome of the combined efforts of health authorities, the federal Bureau of Animal Industry and live stock sanitarians has been to enhance pasteurization in practically all cities and large towns and to make unprecedented progress in the eradication of bovine tuberculosis. Already large areas have been cleared.

The opinion has been held for many years by certain obstetricians that abortion in women is produced by drinking milk from cows that have expelled their fetuses prematurely. In 1913, Larson and Sedgwick[1] found, by the complement-fixation method that the serum of women who had aborted gave a larger number of positive reactions when *Brucella abortus* was used as an antigen than when the usual Wasserman test was applied. Also, they examined the blood of 425 children for antibodies of this organism and found them in 72, or nearly 17 per cent. In one group of children who had been given milk from a dairy in which there had been no abortions among the cows, they did not obtain a single positive reaction. Similar findings have been obtained by others. In 1917, de Forest[2] published a series of twelve abortions in women, in which circumstantial evidence pointed to milk infection.* The specific organism was not found. Recently Carpenter has found it in a fetus.

The historical setting of Brucella infection in man is interesting and it should be understood, to comprehend fully the problem it has brought to light. For many years a disease existed on the isle of Malta and in places bordering the Mediterranean Sea, known as Malta fever. It is characterized by long duration, undulating fever, profuse sweating, and often with shifting, articular pains and a low mortality. For many years it seems to have possessed a local significance only. In 1887, David Bruce, a Surgeon-Major of the British army, isolated the specific organism of Malta fever from the organs of a fatal case. He called it *Micrococcus melitensis*, which is now known as *Brucella melitensis*. The mode of infection was obscure until 1905.[3] In August of that year, George F. Thompson,[4] of the U. S. Department of Agriculture, purchased 65 milking goats on the island of Malta and shipped them to the United States by way of Antwerp,

*I examined the material from one of these cases but failed to find *Br. abortus*. It should be stated that it was not in good condition for a bacteriological examination.

where they were transferred to another vessel. There were, on the ship from Malta to Antwerp, 23 officers and men, most of whom drank the goats' milk. At Antwerp, 11 of the crew left the ship and were not located subsequently. Of the 12 remaining, 8 came down with Malta fever, at intervals varying from 18 to 34 days from the embarkation from Malta. On arrival in America the goats were quarantined at Athenia, N. J. No cases of Malta fever occurred among the officers and crew of the ship. A woman at the quarantine station, who drank the mixed milk from several of the goats, suffered from a typical case of Malta fever. Mohler and Hart[5] found several of the goats to be infected with *Micrococcus melitensis*. As a result of their tests and subsequent studies, it was deemed wise to destroy, not only the imported goats but their offspring as well.

A commission on "Mediterranean fever" found that the goats on the isle of Malta were not only susceptible to artificial infection, but that about 50 per cent of them acquired the disease naturally and that 10 per cent were eliminating the organism in their milk. Monkeys that were fed the infected milk developed typical attacks of Malta fever, which ran a course parallel to that of the disease in man. This discovery led to the pasteurization of the milk used for human consumption, with a prompt and decided reduction in the number of cases on the island. Mohler and Hart considered the complement-fixation test a safer means of detecting infected goats than the agglutination test.

Craig,[6] in 1905, reported Malta fever in the United States. In 1911, Gentry and Ferenbaugh[7] observed that it existed among people in the goat-raising sections of Texas. Evidence was found that it had been there and in New Mexico for at least 25 years. It appeared only among people connected with goat-raising. It is reported by Mohler and Eichhorn[8] that goats may harbor *Brucella melitensis* "for months, even years, without showing the slightest indication of disturbed health." Further, they state, "the most important symptom which is observed among cases affected with Malta fever is the frequency of abortions which result in the course of the disease. Some authors estimate that expulsions of immature fetuses occur in 50 to 90 per cent of the pregnant animals and abortion in affected animals reoccurs also during the succeeding and even at the third gestation following infection."

Watkins and Lake[9] have reviewed recently the literature on Malta fever in this country. The salient facts seem to be that

goats suffer from an infection of which abortion is the essential manifestation; that the udders often become infected with the specific organisms which are eliminated in the milk; and that susceptible people who drink this milk are likely to suffer from Malta fever.

Brucella abortus: For at least two centuries, abortion in cattle has been recognized in Great Britain and on the continent of Europe. Many commissions have been appointed by agricultural societies and others to make investigations into its cause, and many theories have been advanced to explain the phenomena. In 1897, Prof. Bang,[10] of Copenhagen, Denmark, discovered a bacillus in uterine discharges and the fetal membranes of aborting cows which he believed to be its cause. The organism was described as *Bacillus abortus*, but it is now classified as *Brucella abortus* and its specific relation to Bang abortion disease* has been confirmed by many workers in both Europe and America. (Meyer, Shaw and Fleischner[11] proposed the generic name "Brucella" to include the specific organisms of Malta fever and infectious abortion in cattle.)

In 1911, Schroeder and Cotton[12] described what seems to have been *Brucella abortus* as "a new pathogenic bacterium in milk." They were testing market milk for tubercle bacilli by guinea pig inoculations when they produced lesions suggesting those of tuberculosis. They could not find acid-fast bacteria in the lesions nor did they succeed in cultivating the organism which they found on microscopic examination. Their description of the organism suggests *Brucella abortus* and the frequency with which it appeared corresponds to its incidence in the milk of badly infected herds.†

In 1912, Smith and Fabyan[13] pointed out that *Bacillus abortus* inoculated into guinea pigs produced a disease with well-defined lesions and from which the specific organism could be isolated. Later in the same year they[14] described in greater detail the disease in guinea pigs. Since that time these animals have been used by various workers for the isolation of *B. abortus* from fetal membranes, tissues and milk.

*A few other microorganisms have been found associated with certain cases of abortion in cattle and they are believed to be the cause of the trouble in these particular cases. Smith described a spirochaete, Gilman a mold and Plum avian tubercle bacilli, as the exciting cause in certain abortions. The frequency of abortion due to such organisms has not been determined.

†In one series of examinations they reported finding this organism as follows:

Dairy A. 35 samples of milk tested, of which 11 were infected.
Dairy B. 33 samples of milk tested, of which 7 were infected.
Dairy C. 34 samples of milk tested, of which 2 were infected.
Dairy D. 38 samples of milk tested, of which 2 were infected.

Many studies have been made on the presence of *Bacillus abortus* in the milk of infected cows and in market milk that come from dairies affected with Bang abortion disease. A comprehensive study was made of this subject by Evans,[15] in 1918. Zwick and Krage,[16] and Winkler[17] have published concerning its presence in cows' milk in Europe. More recently it has been found by Huddleson, in Michigan; Fleischner and Meyer, in California; Carpenter, in New York, and by many others elsewhere.

In 1914 Traum isolated *Brucella abortus* from the liver, kidney and stomach contents of a porcine fetus. Since that time this organism has been recovered from swine by other workers. The porcine strains were reported to be more pathogenic for guinea pigs than the bovine. Schroeder and Cotton[18] produced abortion in pregnant cows by the intravenous injection of cultures obtained from swine. Cotton[19] failed to infect pregnant sows by feeding bovine strains. Smith[20] studied strains of *Brucella abortus* isolated from cattle, swine and man, and reports that the evidence points to a closer relation between the human and porcine strains than between the human and bovine. Orcutt[21] found identical serological reactions with the strains with which Smith worked.

In 1918, Evans made the observation that there is a very close relationship between the organism of Malta fever and that of infectious abortion in cattle, as established by Bang in 1897. In 1925, she published a helpful paper[22] on *Brucella melitensis*, which tends to prove that there are very slight serological differences between it and *Br. abortus*. Ross[23] found in a study of undulant fever in Southern Rhodesia that the serological examination of eight strains of Brucella isolated from patients showed that six were serologically identical with *Brucella abortus* and two identical with what is recorded as *Brucella para-abortus* strains.

McAlpine and Slanetz,[24] in their studies of the metabolism of *Brucella abortus* group of bacteria, found that *Brucella abortus* of bovine origin utilizes very little, or no, glucose in its metabolic activity, while *Brucella abortus* of porcine and human origin and *Brucella melitensis* consumed from 4 to 18 per cent of this carbohydrate for growth and energy. Carpenter* has reported a strain of *Brucella abortus* isolated from milk that utilizes 12 per

*Paper read at the meeting of the American Public Health Association in Chicago, 1928. Will appear in report of the meeting.

cent glucose. The typical bovine type of *Brucella abortus*, according to Smith,[25] will not produce abscesses in the lymph-nodes and spleen of guinea pigs, while a majority of porcine strains will do so. Olafson* found that a culture isolated from certified milk, and which had been under cultivation for three years without being passed through guinea pigs, produced abscesses. The fact that it was isolated from milk does not preclude the possibility that it might have been of porcine origin.

In 1924 Keefer[26] reported the first case of human infection with *Brucella abortus* in America. The clinical picture was that of Malta fever. No evidence could be found that the patient had been in contact with goats, but he had been a heavy drinker of raw cows' milk. The organism obtained from the blood was identified by Evans as *Brucella abortus*. De Korte[27] reported a case of undulant fever in a man who became infected by removing the placenta from a cow that had aborted. Duncan[28] mentions a case in a butcher who was a heavy drinker of raw milk. Orpen[29] discovered a peculiar fever in Rhodesia due to *Brucella abortus*. Ficai and Allessandriani[30] record an epidemic of Malta fever in Italy in certain cases of which there was septicemia.

In 1926, Moore and Carpenter[31] reported five cases of human infection and the virulence for cattle, of the organisms obtained. The first case observed was of special interest. A student at Cornell University became ill with a disease diagnosed by his physician as typhoid fever. Later, miliary tuberculosis and malaria were suspected. Cultures of his blood made by Carpenter revealed *Brucella abortus* only. They were repeated and always with the same results. The disease ran a course of 12 weeks when recovery followed. Clinically he presented a syndrome of Malta fever. This patient had drunk heavily of raw milk from a dairy in which abortion of a severe nature prevailed. During the time of his illness, there were five other cases of an undulant type of fever among people who had drunk milk from the same dairy. Their existence was not known to us in time for blood examinations. A culture of the organism obtained from this case was injected into a pregnant heifer. She exhibited a severe reaction and aborted in 20 days. The organism was isolated from the fetus and the placenta. She was destroyed 6½ months later and the same organism was recovered from her milk, lymph-glands and spleen. It was virulent for guinea pigs.

*Thesis presented to the Graduate School, Cornell University (1927) for the Master's degree pp. 13 and 27.

The Metropolitan Life Insurance Company became interested in this subject and made it possible financially for us to make a local survey to determine the incidence of human infection with this organism, and also the extent to which cows in aborting herds produce infected milk.* This has resulted in finding in central New York 52 cases of undulant fever due, as far as determined, to this infection. Seventeen cases were in one city.† In a recent paper by Francis‡ he refers to 354 cases of undulant fever that have originated in 31 states. He emphasized the necessity for more publicity of the subject for, in his opinion, it constitutes a serious problem in public health. Carpenter and Baker[32] found *Brucella abortus* in the market milk of 9 of the 50 dairies supplying one city. Carpenter and King report it in 20 per cent of the samples of raw market milk of 67 towns, 2 small cities and one city of 200,000. Many other observers have reported cases, some of special interest, but these are sufficient to point out the wide distribution and general character of this infection in man. At the recent meeting of the American Public Health Association in Chicago there was a symposium on this subject at which seven instructive papers were presented.§

An analysis of the numerous studies of undulant fever and the researches on the incriminating organism will show that there are certain differences of opinion as to the genesis of *Br. abortus* infecting man. As Malta fever has been demonstrated to be caused by *Brucella melitensis* that produces abortion in goats, and as it is very closely related to *Brucella abortus* in cattle, there are suggestions that at least certain cases of undulant fever in man may be traced through the cows to goats. Again, as the organism isolated from man is more virulent for guinea pigs than the one obtained from cattle, it is thought by others that human infection is caused by the porcine type. Further, there are many interesting questions relative to the mutations or varieties of *Brucella abortus* isolated from cattle. Whether or not in the beginning tbe organism of Malta fever was transmitted from goats to cattle and that after a longer or shorter time it became transformed to *Brucella abortus*, or, whether or not the germ of infectious abortion in swine has gained entrance to cattle where it may be perpetuated and occasionally escape from them to

*Carpenter and his assistants have done the laboratory work.

†Eleven of these were University students, 2 instructors, 3 housewives and one a high school pupil.

‡Presented at the 34th Annual Conference of Indiana State Health Officers at Gary, Ind., Sept. 26, 1928.

§These will appear in the American Journal of Public Health.

man through milk or otherwise, are questions for the bacteriologists to answer.

This association is concerned with the practical solution of an existing sanitary problem affecting man and cattle. The important question is, "How can human infection from apparently the bovine species be prevented?" The local cases of which we know were heavy milk drinkers, and their supply came from a herd in which there had been much abortion. Swine were not kept on the farm nor did the attendants have anything to with hogs. In one instance, the cow that had been set apart for the family supply was the only one in the entire herd of thirteen animals that was eliminating the organism in the milk. *Brucella abortus* is present in the cream from infected milk and, according to Carpenter, it will live for a long time in sweet butter. We have not found it in cheese. There is strong circumstantial evidence that infection takes place through the ingestion of infected raw milk.

The argument advanced that, because of the wide prevalence of Bang abortion disease in cattle, if human infection were caused by the use of milk there would be many more cases of undulant fever than there are, does not hold necessarily. There is still much to be learned relative to the resistance of the human species to this organism, the number of bacteria that are necessary to cause infection, and the frequency of the coexistence of the necessary factors, before one can state that the relatively small number of cases in man contradicts the present hypothesis that infection takes place through the ingestion of milk containing the organisms. Francis* states that there are more cases than have been recognized. It is not unlikely that there are other forms of manifestation which at present are attributed to other causes. Carpenter found *Brucella abortus* in necrotic areas in eight tonsils, which confirms the findings of Mohler and Eichhorn[8] many years ago. Certain cases of endocarditis and joint lesions may be included in its effects on man.

As pasteurization destroys the organism, health officials can protect the public by having market milk treated by that process. Its efficiency was proven on the isle of Malta. Its value is illustrated further by the circumstance, quoted by Ward, at Earlham College, a Quaker school in Richmond, Ind., with about 500 students. In January, 1928, there was an epidemic of some 14 cases. The college had its own dairy of 20 cows and the milk

*loc. cit.

was used in the raw state. Ten of the cows reacted to the agglutination test and three were eliminating *Brucella abortus* in their milk. Pasteurization was begun and no further cases appeared. We have not found a case of undulant fever in a person who used consistently pasteurized milk.

There is this close resemblance between the sanitary significance of Bang abortion disease and bovine tuberculosis, that in each the infecting organism is carried in the milk. In each the protection of the public is accomplished by the same procedure: obtaining the milk from uninfected cows or subjecting it to pasteurization. Dr. Wm. F. King, State Commissioner of Indiana,[33] recently summarized the situation in these words, "No health administration official can stop short of the pasteurization of all milk."

Notwithstanding, it is clear that with this infection, as with tuberculosis, consumers are in no danger from this organism in milk if the cows that produce it are not infected. It is possible and practical, to have raw milk safe as far as this trouble is concerned. From the public health point of view, the control of human infection with *Brucella abortus* consists either in the pasteurization of market milk, or the eradication of Bang abortion disease. Unfortunately, pasteurization is not satisfactory in small villages and the countryside, and it is doubtful, because of its requirements, if it ever can be made so where small quantities are treated. The complete solution of the sanitary problem, therefore, involves the elimination of the disease from cattle.

For a number of years researches on the nature of Bang abortion disease have been in progress. As a result, many facts* in its life history have been revealed that can be utilized advantageously for its control. They have expanded the routine of veterinarians to include a highly important sanitary service. The recognition of these truths has simplified the handling of the disease and made it possible for practically every owner to ascertain the individuals in his herd that are infected, and to grow up a clean herd of cattle and maintain it free from this trouble. The more essential of these recorded facts are:

(1) *Brucella abortus* is established as the cause of Bang abortion disease. Many of its properties, its usual mode of infection and means of dissemination are understood.

*Due acknowledgement is made to the splendid work of Bang, Barnes, Birch, Cotton, Fabyan, Fitch, M'Fadyean, Meyer, Schroeder, Smith, Traum, and many others, who have pointed out certain truths pertaining to the course of this infection and the reactions of the host to it.

(2) The agglutination test, while not perfect, has been demonstrated to be very efficient for detecting animals that are carrying *Bacillus abortus*. The complement-fixation method is considered equally as good or more satisfactory by some.

(3) Calves raised in the natural way in infected herds will, if separated from the source of infection when but a few months old, usually become free of the organisms before they arrive at breeding age. Carpenter found experimentally that calves fed milk containing *Brucella abortus* would harbor the organisms in their mesenteric and throat and head glands for a period of from 5 to 6 weeks after the infected milk was withdrawn from their food. These findings were in harmony with those previously obtained by Conway and others.[34] This means that calves in diseased herds may be grown into sound and uninfected cows.

(4) Many young (especially unbred) heifers become infected because of contact with spreaders and give temporarily a positive agglutination test, that if removed will overcome the infection, cease to react and, as far as known, do not themselves become spreaders. Such animals remain negative to the test and can be considered as uninfected, or clean.

(5) There is an appreciable immunity or resistance established in cattle that have been through the Bang abortion disease. Cows that become infected usually go through a two-year, unstable breeding period and then providing they have not become sterile, build up and make fairly satisfactory breeders and milk-producers. If such cows breed, they are far more satisfactory to place in an infected herd than uninfected or clean animals would be. When cows that abort are properly cared for, a large percentage of them breed subsequently, although there is a certain tendency to sterility.

(6) Notwithstanding statements to the contrary, many herds that have been built up by breeding are *free* from Bang abortion disease. There are many others in which there are but a few infected animals. If they are detected, segregated or removed, the herd will remain clean.

(7) The infection is introduced usually by bringing into the herd one or more infected animals which are obtained from infected herds or from sales where no precautions are taken either to detect or exclude such animals.

The application of these facts has found expression in very definite methods for the control of Bang abortion disease. The well-known Pennsylvania plan, which involves official super-

vision, is based on the specific nature of the disease and the ability to detect and remove infected animals. Birch and Gilman[35] have proposed a somewhat similar procedure for handling infected herds, based on the same fundamental facts, and which if followed will result eventually in clean herds. The results are accomplished with the coöperation of the owner and his veterinarian, with the assistance of a laboratory for the agglutination or other tests that are required, in case the veterinarian himself is not equipped to make them. Further, the owners must be instructed how to proceed in the circumstances in which they find themselves. For this reason they must have wise counsel based on the scientific findings in their own herd. By this means eradication is accomplished without taxing the state or causing serious hardship to the owners. The procedure possesses the necessary educational requirements to leave the owner, when the process is completed, with knowledge sufficient to keep the disease away in the future. In all methods of control, the elimination of infected animals is but one step, the keeping of the infection out subsequently is equally as difficult a task and one that involves the application of knowledge on the part of the owners themselves.

These plans are working very satisfactorily. Many infected herds have been cleaned, and many more are in the process. The breeding efficiency is enhanced, abortion eliminated and production improved. The owners of such herds are more than pleased. The results already obtained justify the conclusion that eliminating the virus and keeping it away subsequently, is the practical method of handling this disease. Further, and of still greater importance, a method of control that involves the owners and their veterinarians only can be applied simultaneously throughout the country. At least, it makes it possible for every breeder or dairyman who wishes to have a clean herd to realize his desires.

The primary object of any control project is to get as many herds as possible entirely free of the disease. There are hundreds of herds which harbor but a few reactors, but these constitute a great potential danger. Their detection is not difficult and their elimination is possible in most cases with but little or no loss. The sale of reacting breeding animals should be encouraged only if they go into herds containing a high percentage of reactors and with the full knowledge of the purchaser. Here, as with tuberculosis, the herd is the unit to deal with.

Some states require a negative blood test to admit cattle, without specifying the status of the herds into which the clean animals are to be put. Often they are placed in infected herds which practically insures abortion in the new animals. In such instances, it would be much safer to bring in reactors that had passed safely through the disease and had become efficient breeders. There is a certain "fitness of things" in matters of control. The laws of chance should not prevail but care should be taken to place clean animals in clean herds only. In all sales it would be sound policy for the records of the agglutination test, or tests, to accompany the animal whether it goes to another state or not, and the disposition of the animal should be determined according to the facts. Clean and infected animals should not be included in the same shipment.

Many breeders who have found by careful tests that their herds are clean, or who are in the process of eliminating the disease, desire some official record of the fact which they can use legitimately in selling their animals. Dr. Birch has suggested the self-defining term, "recorded herds," that could be employed for this purpose. In other words, records of consecutive tests should be kept on file, for often it is important to know how long an animal has been reacting and how high, if the most accurate appraisal of her status is to be made. This would not bar the term "accredited" for herds that show tests consistently negative, but it would give a man, who is in the process of cleaning up, some recognition and enable him to sell his cattle for exactly what they are. This could be official if it is deemed wise or necessary. Temporary loss of accreditation, which might be due to a single temporary reaction, would not be unduly severe as far as the reputation of the herd is concerned.

Cattle-owners and milk-consumers should be very grateful that scientific researches have revealed definite information relative to the etiology, course, diagnosis and control of Bang abortion disease, which will serve as a foundation for a workable method to detect and eliminate infected animals. Further, this knowledge points out with great clearness how sound herds can be protected, how new herds can be assembled free from disease and how public sales may be conducted on a safe basis. If these truths are recognized and squarely faced, undulant fever will disappear, and dairymen and cattle-dealers will find themselves operating on a much higher plane of conduct and in harmony with modern sanitary laws and requirements.

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Discussion

President Cary: To discuss this paper I shall first call on Dr. A. V. Hardy, Acting Assistant Surgeon of the United States Public Health Service, Dr. Hardy! (Applause)

Dr. Hardy: I presume that I have been asked to discuss Dr. Moore's paper because of our investigations of undulant fever in Iowa. For this reason I do not hesitate to report somewhat briefly our investigations and indicate some of our findings.

The first case of undulant fever was recognized in Iowa just about two years ago. At that time even physicians were somewhat skeptical of the accuracy of the diagnosis. Six months later a case was admitted to the University Hospital with a diagnosis of typhoid fever. The Widal test was found to be negative, the stool and blood cultures failed to show typhosus but melitensis was isolated from blood cultures. From that time, the State Laboratory has routinely examined for undulant fever all blood specimens sent to the laboratory for agglutination tests for typhoid. The result has been that a considerably greater proportion have been found to be positive for undulant fever than for typhoid fever.

In the eighteen months in which this procedure has been carried on, the diagnosis has been established in over 150 cases, and the number, I may say, is considerably greater in recent months than in the earlier months.

It is also interesting to know that the physicians naturally have been unusually interested in these cases; most have been seen by more than one practitioner and a good many by the State's best consultants. In no instance after undulant fever was suggested as a diagnosis was any other diagnosis made. Perhaps I should qualify that by saying that there were two cases in which it was known that undulant fever was complicated by malignancy. Barring these two cases, no other diagnosis was made.

The clinicians of the State are agreed that clinically these infections are undulant fever and nothing else. Blood cultures have been rather difficult

to get, in view of the fact that the cases have been very widely scattered over the State. We have, however, obtained some cultures and have obtained the organism from seventeen of the cases. I may say that in those cases close at hand, where conditions were satisfactory for reliable bacteriological study, the cultures were positive in a high proportion of the instances.

I think it is rather generally agreed by the practitioners that they have been seeing cases of this type for many years past. Just yesterday, when I was attending a clinic held in northern Iowa, one practitioner said, "Haven't all these cases of atypical typhoid in which we have had negative Widals been undulant fever?" Probably they have been. Indeed, frequently we have been able to establish a diagnosis of undulant fever in cases that have occurred within a year which have gone undiagnosed or were given an unsatisfactory diagnosis. It is no new disease that we are finding there, but we are merely recognizing one that has been there for an uncertain number of years.

Very early it seemed apparent that an epidemiological investigation should be undertaken in these cases. This was made possible through the financial cooperation of the United States Public Health Service. When a few cases only were being recognized, that is, in the early months, it was comparatively easy for one person to investigate the cases and obtain blood specimens from animals that seemed to come under suspicion. As more and more cases were being recognized, it became more and more difficult to investigate all these cases, a procedure which indeed at the present time seems highly desirable.

Therefore, those who were interested in the human side appreciated deeply the desire and willingness of those in the State interested in animal industry to cooperate, and at the present time I believe we are beginning on a plan that will work out very effectively. I think I may just briefly sketch this plan: Blood specimens are examined by the agglutination test for undulant fever in only the State Laboratory. In this way we get in touch immediately with the cases that are diagnosed in the State. Following that, either I or my assistant will make an investigation of the case. This cannot always be done immediately, because the cases are very scattered and it would keep both of us running all the time if we tried to make the investigation immediately. But within the course of the disease or during convalescence, we do make the investigation.

Some stock will be brought under suspicion. Dr. Malcolm has prepared a request for examination of stock. We explain it to the farmer, for it is usually in a farmer's home where we find undulant fever or he has it himself, and invariably he appreciates greatly this attempt that is being made to trace the source of his or his family's infection. Occasionally a dairy herd will be very definitely brought under suspicion. That is more difficult to handle and must be handled more cautiously. I have found, however, that dairymen are, as a whole, concerned for the health of their patrons and will be quite willing to cooperate in any investigation which has as its aim the protection of the public health.

One must bear in mind, however, that this investigation must be done in such a way that the dairyman's products will not be brought under great suspicion, and it can be done in such a way, though it is quite difficult at times.

When these requests are signed, I send them on to Dr. Malcolm. Dr. Malcolm directs one of the assistant state veterinarians in the county in which the case occurs to make the examination. I send the blood tubes and needles for collecting the blood specimens to this veterinarian. After the specimens are collected (which, by the way, are taken in duplicate), one from each animal is sent to the State Laboratory and the other is sent to the Veterinary Research Department of the Iowa State College. The results of the findings will be filed with the State Department of Agriculture.

As I say, at the present time we cannot tell you how well this plan will work out, but I think we all are very optimistic for the future, and certainly we have been, and I think I may say for the others, we have enjoyed our contact in the approach to this problem. If this plan is continued for, let us say, two years, I think we will have very valuable information.

For the health officials or physicians concerned with this disease, I may say that we appreciate very keenly the hearty cooperation that is offered in the study of this problem which we now recognize as an important health problem.

I should like to say one word regarding the importance of undulant fever, and I do it for this reason: Just the other day, in discussing the problem with a man keenly interested in it and closely connected with the live stock industry, he made the statement, "Well, if they do occur, the infections are no more important than a severe cold." No statement could be further from the truth. It is true the mortality is not high, though four of the 150 cases in Iowa have ended fatally; the duration though is very prolonged, not always, but on the average. The average duration of the cases in Iowa which have apparently terminated has been about three and one-half months, some lasting over ten months. As a matter of fact, there are two cases that have been sick for ten months and are still sick. I will assure you that no one needs to see very many of these cases to appreciate not alone the physical discomfort involved but the utter disappointment and despair with this seemingly never-ending disease and will appreciate that it is urgent that every means be taken to prevent its occurrence.

I should like, if I might, to add one further word to what Dr. Moore has said regarding the occurrence of undulant fever in the United States. Let us bear this in mind: In 1926 undulant fever in the United States was a medical curiosity. No one suspected that it occurred at all frequently. In 1927, something over 100 cases (not as many as 125 cases) were recognized. In 1928, taking only about the first eight months of the year, we know that there have been at least 350 cases recognized, and I certainly think, before the year is done, there will be at least 500 cases recognized in the United States. More than that, in every state where effective measures are taken to obtain the recognition of undulant fever, a number of cases have occurred. The occurrence or the apparent occurrence of undulant fever is directly related to the measures taken for its recognition.

I may say further that in no state is there any evidence that the infection does not occur. In those states where no case has been recognized, no measure has been adopted in order to obtain its recognition, and until a state can say that there is no undulant fever, they must now prove that it does not occur, because we have evidence that wherever it is looked for it does occur. It is merely a matter of guess as to what the future findings will be, or how prevalent undulant fever will prove to be.

Regarding the source of this infection in the United States, I shall dismiss the goat as a source, though there are infections in the southern states which we do trace back to goats. However, I am entirely in agreement with the impression left by Dr. Moore. Certainly our experience in Iowa does not allow us to say that cattle are the only, or perhaps even the chief, source of the infection. We do recognize that cattle are a source, but we have, in Iowa at least, to take hogs very definitely into consideration. Nor do I think that we are justified in Iowa in assuming that milk is the most common factor for consideration. Taking this fact into consideration, of the 125 cases, 97 were males and the rest females. Of those cases occurring on the farms, there were 58 farmers and only 8 farmers' wives. On the basis of a milk-borne epidemic you cannot explain that evidence. It is very clear that the men who are exposed to the infection through caring for infected stock, through handling infected meat as in packing-houses, are very liable to acquire the infection.

It is true there is a certain proportion of the cases, about a third in number, in which the only source for the infection that we know at present is through the use of raw milk.

I should at least like to leave my own impressions that we cannot at the present time lay the whole blame on cattle or the whole blame on raw milk. The evidence, or at least our evidence, is not explainable on that basis. Perhaps, if I may be allowed just one moment further, I could mention our findings in packing-houses in Iowa.

We have now fifteen cases among packing-house workers which the physicians have diagnosed and on which we have laboratory confirmation. Because of this, in one packing-house we made a survey of apparently healthy employes and 217 volunteered to have blood tests made. Of that 217, 29 gave agglutination titers of 1 to 80 or higher, maximum titers going up to 1 to 160.

I was in that packing-house yesterday and saw nine workers whom my assistant, Dr. Jordan, had not previously seen. Of those nine, one only failed to give a history at least suggestive of undulant fever. In two cases it was rather doubtful. One had a history of lumbago and general symptoms. Generally, the common backache is associated with undulant fever. The other case was a Mexican who had been sick and I didn't know with what. The six other cases gave a clear-cut story of a previous infection with undulant fever. Even there in that city, in which several cases had occurred and the physicians were unusually on the alert to obtain its recognition, cases were being missed. How many cases in the United States are still in that big list of missed cases is wholly a matter of guess at the present time.

I am sure Dr. Huddleson will stress the importance of the porcine strain in causing human infection, but let us bear this in mind: The porcine strains must come from cattle and you must take the epidemiological evidence into consideration as well as bacteriological evidence. Bacteriological evidence is important, but you have to include the epidemiological evidence also.

Clearly, then, here is a problem in which those of you interested in live stock sanitation and those interested in human health must, and with profit may, cooperate very intimately. It obviously is important that we obtain accurate knowledge so there may be a prevention of human infection without jeopardy to the animal industry. (Applause)

President Cary: The next man to discuss this subject is Dr. I. F. Huddleson, of Michigan State College.

Dr. Huddleson: In order to learn more about the source of infection in man we have felt it desirable, from the very beginning, to learn more about the distribution of the different varieties, or species, which is a better term, of this abortus-melitensis genus in different animals, as to their occurrence in cattle, in the hog, in the goat and in man.

It has long been known and is now a fairly well established fact that there are three different species or varieties of this organism, that is, the melitensis, the porcine abortus strain and the bovine abortus strain. In the past it has been rather difficult always to arrive at the classification of a given strain when it was isolated from a host; that is, if we should find a strain outside of its supposed host, it would be rather difficult to say or explain its occurrence. We have not known very much about whether the porcine strains occur in cattle or whether the bovine strains occur in the hog or whether the melitensis may be found in the hog or cattle, or whether the porcine or bovine type may be found in the goat.

We have conducted a study up to the present time on over 220 strains of this organism coming from different parts of the United States, from different parts of Europe, and from Rhodesia. We have so far studied about 100 strains coming from the cow, and according to our method and classification, 86 of these strains were of the bovine abortus type and 8 of them belong to the porcine species. Of those 8, 2 were isolated from milk of the cow; one from the testicle of a bull and the others from aborted fetuses. Two of these 97 strains were melitensis. Not very much has been said about the melitensis in cattle and little is known about the melitensis in cattle in this country. These two strains have been differentiated by all presently known methods of differentiating the strains.

Then we come to the strains from the hog. These have been obtained from all parts of the United States and strains that I have obtained from Hungary. They have quite a bit of swine abortion in Hungary. I have twenty of these strains and all are of the porcine type. In other words, we have never yet found a bovine or melitensis species occurring in the hog. Of course it may be possible if a hundred strains of porcine type from the hog were examined we might find the others, but so far there is a good indication that these other species do not occur in the hog.

Then we come to man. I have not been able to obtain all the strains that have been isolated from man in this country, but this group represents practically a majority of the strains that have been isolated so far. About 46 strains have been examined outside of known strains of melitensis which have occurred in laboratory workers and strains coming from the southwestern part

of the United States. Of this number, 21 are of the bovine abortus type and 25 are the swine or hog type. Of this 21, 15 have been isolated in Michigan, 4 of them come from Rhodesia, one from India, one from New York State and one from Iowa.

We have never isolated the swine species from human cases in the state of Michigan. Most of the strains that I have studied from other states belong to the porcine type. Dr. Hardy has sent to me 14 strains and 10 of them belong to the porcine species; 45 strains have been examined from Europe, from countries bordering on the Mediterranean, and all 45 belong to the melitensis species.

From the horse, two strains have been studied; one belongs to the bovine abortus type and one to the swine type.

From the goat, 15 strains have been studied and all 15 belong to the melitensis species. In one instance we found in a culture both the swine species and abortus species.

The origin of the swine species in cattle is something that I cannot throw very much light upon. Did they come from the hog, or is the swine species occurring naturally in the cow? Do the hogs get this strain from associating with cattle, or do cattle get it from associating with hogs? It appears that the swine species occurs in certain sections of the country more than in others.

We also have been interested in the pathogenicity of these three species of this genus, that is, in order to determine something about the relative virulence for man. In order to do that we have gone to the monkey as it is a well known fact now, from past history, that the monkey is a very good animal to study the pathogenicity of the melitensis on, because the type of disease which results in a monkey very closely resembles that which is found in man. From these studies we have found that the porcine species is the most pathogenic of all. It is even more pathogenic than melitensis.

When you come to the bovine abortus species, it is very difficult to produce the disease in monkeys, at least what I should call the disease. It takes repeated feedings in large doses of even newly isolated strains or milk or even the stomach exudate from aborted fetuses. The monkeys recover very rapidly from infection. If you let the monkeys go long enough after the symptoms of the disease disappear and they disappear in about a week's time, the agglutination reaction of the monkey becomes absolutely negative. After this, of course, the monkeys are not susceptible to any of the three species, even the swine species.

It is rather difficult to produce the disease with old strains of melitensis. In newly isolated strains which I have obtained it can be done and even monkeys will recover from that.

In the case of the porcine species, the monkeys never recover. In not a single case have I had one recover yet, although the studies have been rather limited.

You may remember that Dr. Meyer, of California, did considerable work along this line back in 1920 or 1921. Of course, at that time, he was using old cultures of abortus and swine species. He had great difficulty in producing disease in monkeys. It took weeks and even months of constant feeding before he could produce anything like undulant fever in the monkey. (Applause)

PRESIDENT CARY: The next paper on this subject is "Suggestions for Rational Control Measures for Bang's Disease," by Dr. T. E. Munce, president of the American Veterinary Medical Association, Harrisburg, Pennsylvania. (Applause)

. . . Dr. Munce read his paper. . . . (Applause)

BANG DISEASE FROM A REGULATORY STANDPOINT

By T. E. Munce, *Harrisburg, Pa.*

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The problems of prevention, control, and eradication of transmissible animal diseases, including the diseases of poultry, are clearly duties of the federal and various state sanitary and regulatory organizations and are under their jurisdiction by law. Most states do have and every state should have such an organization. For work of this nature to be successful, it must be conducted under a definite policy and must be properly administered from a central point. It should be supported by all individuals and organizations concerned.

Bang disease of cattle is due to a specific cause which is transmitted from one animal to another. It is introduced into and is spread in herds through the introduction of infected animals. After its introduction into herds, the economic loss caused is probably not surpassed by that of any other cattle disease now prevalent in this country. These facts make Bang disease clearly one which should come in the class of diseases controlled by regulating the movements of infected animals.

A definite knowledge of the nature of a disease must exist before regulations helpful in a policy of prevention, control, and suppression can be intelligently formulated. Unless such knowledge is available, no successful policy can be pursued. It is not a wise policy for any state to draw up drastic regulations on any existing disease and offer no other solution unless the enforcement of these regulations will restrict said disease within the state or exclude it from the state. On the other hand, a state is justified in promulgating and enforcing such regulations as will cause economic live stock production by preventing the spread of a disease from one herd to another.

We have known the cause of Bang disease for more than thirty years, yet, the definite knowledge needed for the formulation of proper regulations helpful in the control of this disease has been available for less than ten years.

Beginning about ten years ago, principles were carried out in a few herds in Pennsylvania which subsequently became the principles involved in a definite plan for the effective control and

elimination of Bang disease. The results obtained through carrying out these principles soon demonstrated to breeders, the difference in production between Bang-disease-infected herds and Bang-disease-free herds. This in itself is sufficient cause for the great demand which there now is for work of this character.

In face of the fact that there still remains much to be learned in the study of Bang disease, the voluntary plan of control and eradication recommended in Pennsylvania is now beyond the development stage. A review of this development would be only to repeat what has already been said before this association. The paper one year ago by Drs. Barnes and Church reported that approximately 25,000 blood samples were tested for Bang disease in 1927; that testing was being done in 800 herds; that 250 herds were signed up under the Pennsylvania Plan; and that 49 herd-owners held certificates—"Bang Disease Free"—with an average of 34 cattle per herd.

During the year 1928, there will have been approximately 40,000 blood samples tested for Bang disease; 1902 herds are being blood tested; 600 herds are signed up under our plan; and exactly 100 Bang-disease-free herd certificates have been issued. To our knowledge, only one break occurred during the current year.

Thirty years ago, more or less effective plans were instituted in an effort to control this disease and quite a number of variable nature have been instituted since.

Any plan devised for the effectual control and eradication of Bang disease or any other transmissible disease must of necessity regulate the handling of infected animals.

The most successful of the earlier plans were those based on the principles of sanitation. The most successful today have basic principles of sanitation, together with the application of the blood test to detect infected animals and includes the separation of the infected and healthy animals.

It was only after the systematic carrying out of the previously mentioned combined principles over sufficient period of time that we were successful in the elimination of Bang disease from herds of cattle. In doing so, we took advantage of the existing available knowledge concerning this disease.

The fact having been established that Bang disease is due to a specific cause, and also, that the disease, to some extent at least, has a dangerous relation to human health; that a successful plan of prevention, control and elimination has been in operation for

some time, offers reasonable justification for having protective regulations and regulations to prevent its further spread.

A plan offering a means of finding Bang-disease-infected animals and requiring the removal of diseased animals from herds by disposal or otherwise, without placing restrictions upon their movements or regulating their place of disposal, is a most dangerous weapon when used by advocates of other methods.

That is exactly what the Pennsylvania plan was before Bang disease was proclaimed to be a transmissible disease and regulations were promulgated which define what is meant by an infected animal and specify the manner in which infected animals must be handled.

Yet, the Bang Disease Plan was an agreement between the owner and the Bureau, and while it permitted one owner who had reactors to sell them to another and possibly in each case spread the disease, this was seldom done because owners were advised differently and usually heeded the advice. (This advice might be considered an unwritten part of the agreement.) The fact that the plan did not specifically require proper disposal of reactors, and could not, because the disease had not been proclaimed transmissible, constituted an inconsistency in the Bureau's policy; for, while it helped one breeder to get rid of this disease, it permitted its spread to other herds. Nevertheless, the plan did require that reacting animals be separated on the premises or disposed of in a manner satisfactory to the Bureau. The voluntary plan thus, in most cases, served the purpose of regulations most easily and effectively enforced. That which is voluntarily done is usually done better than when compulsion is attempted.

Unless the live stock owners show a willingness and participate voluntarily in the elimination of diseases, this end is difficult of accomplishment by regulations. Those to be regulated should first understand and be in sympathy with enforcement regulations. Regulations serve as a protection to the enforcement agents and afford a means of overcoming the flare-backs of a few, in carrying out a program with which the majority are in sympathy.

Sometimes regulations are improperly placed. There is a distinct difference between health and disease, yet, the wall between the two is not very high, that is, the resistance to disease is not very great in most cases. The best way to keep animals free from disease is to keep the cause and the susceptible animal apart. With these two together, the only wall which exists is the natural

resistance of the susceptible animals. Regulatory bodies too often spend their efforts, to some extent at least, in the wrong place; on the wrong side of the wall. We are prone to penalize the owner who is trying to eliminate disease and is already penalized—the man who can least afford to be penalized further. It is our duty to protect and assist rather than to penalize such owners. We enforce our regulations on the owner who has diseased animals and who is already suffering a penalty and possibly innocently. Why not penalize the owner who knowingly exposes healthy animals? He can do as much or more harm to the live stock industry than the other had done. If he is penalized at this time and the handling of his live stock regulated, it will not be possible for him later to cause other animals to be exposed. We should aim to build the wall higher between health and disease.

That is exactly what we have aimed to do in Pennsylvania. The general policy of the Pennsylvania Bureau of Animal Industry involves individual policies for the prevention, control and eradication of the various transmissible animal diseases. In conformity with this general policy, Bang disease is handled by the one plan devised for that purpose and by none other. Herds that do not or cannot fit into the requirements of this plan do not operate under it. We should not have one definite disease control plan and operate under a dozen plans.

The policy of the Pennsylvania Bureau of Animal Industry for the prevention and elimination of Bang disease also involves regulations which supplement the plan. At the time of their adoption, we considered that these regulations were sufficiently stringent for a beginning. Such as they are, we have experienced no difficulty in their enforcement and would not expect to experience much difficulty if they were made considerably more stringent. In fact, we now contemplate the proposal of more stringent regulations for the consideration and possible enactment into law by our next legislature.

To those who are considering regulations on Bang disease, we would suggest the following as worthy of consideration:

Regulation for the Control, Prevention and Suppression of Bang Disease

Regulation Number........................
Effective.................................

Section I

Defining Bang Disease

Paragraph 1. Bang Disease shall mean the disease wherein any animal is infected with Bang bacillus irrespective of the occurrence or absence of an abortion.

Paragraph 2. An animal shall be declared infected with Bang bacillus if it has given a positive reaction to the blood test or any other recognized test for Bang disease; or if Bang bacillus has been found in its body, its secretions, or discharges; or if it has been treated with a live culture of Bang bacillus. Any animal which has aborted or shows physical symptoms of Bang disease shall be considered infected with Bang bacillus until such a time as it is proved negative to a recognized test for Bang disease.

Section II

Restricting Infected Animals

Paragraph 1. Animals infected with Bang disease as defined in Section I of these regulations shall not be sold, given away, or removed from the premises except under permit. Permits for the removal of infected animals will be issued by the Pennsylvania Bureau of Animal Industry under the conditions that their destination shall be immediate slaughter or infected herds; or that their destination shall be such as not to expose them to healthy animals. They should, however, be separated from healthy animals on the premises.

Paragraph 2. Animals infected with Bang disease, as defined in Section I of these regulations, shall be placed under quarantine, when such measure is deemed necessary by the Pennsylvania Bureau of Animal Industry to prevent the spread of said disease.

Paragraph 3. In each and every case where animals, infected with Bang disease as defined in Section 1, are to be given away, sold, or offered for sale, the condition of their health shall be properly represented and they must be represented as infected animals.

Section III

Protecting Healthy Animals

Paragraph 1. It shall be unlawful for any person to expose healthy animals to animals infected with Bang disease as defined in Section I of these regulations unless authorized by the Pennsylvania Bureau of Animal Industry.

Paragraph 2. This section of these regulations shall, by "Healthy Animals," mean all bovine animals not infected with Bang disease as defined in Section I of these regulations.

Section IV

Entry of Infected Animals

Paragraph 1. Animals infected with Bang disease as defined in Section I of these regulations shall not be brought into Pennsylvania except upon written permit from the Pennyslvania Bureau of Animal Industry.

Paragraph 2. Animals brought in on such permit shall be subject to quarantine and state regulation immediately upon their entry into Pennsylvania.

Paragraph 3. All bovine animals for entry into Pennsylvania for breeding or dairy purposes must have been tested for Bang disease within ten days, with a test recognized by the Pennsylvania Bureau of Animal Industry, or must come from herds recognized by the said Bureau as free from Bang disease and must be accompanied by a health certificate. Each such health certificate shall be signed by the veterinarian who shall have made the test and shall contain a complete statement of the actual results of the test and a description for identification, of each animal tested, and the name and address of the owner or consignor, the name and address of the participating laboratory, and must be approved by the proper regulatory officials of the state of origin.

Section V

Making Tests Reportable

Paragraph 1. All blood tests and all other diagnostic tests for Bang disease in Pennsylvania shall be reported in writing within one week after such test to the Pennsylvania Bureau of Animal Industry at Harris-

burg. Each report shall be signed by the person who shall have made the test and shall contain a complete statement of the actual results of the test, a description for identification of such animal tested, and the name and address of the owner, and shall contain the name and address of the participating laboratory.

Section VI

Control of Biologics

Paragraph 1. It shall be unlawful for any person to manufacture for sale, or sell or offer for sale, any biological product intended for diagnostic or therapeutic purposes with animals, excepting upon specific permission to do so from the Pennsylvania Bureau of Animal Industry at Harrisburg.

Paragraph 2. No person shall inject into or otherwise administer to any domestic animal, any live germs of a kind virulent for man or animals, excepting upon specific permission to do so from the Pennsylvania Bureau of Animal Industry at Harrisburg.

Section VII

Sale and Use of Biologics

Paragraph 1. The holder of a permit to manufacture biologics shall report to the Pennsylvania Bureau of Animal Industry, Harrisburg, Pa., within one week, each sale of any biologic designed for the diagnosis or treatment of Bang disease.

Paragraph 2. The holder of a permit to administer any biologic for the treatment of Bang disease shall report to the Pennsylvania Bureau of Animal Industry, Harrisburg, Pa., within one week, a record covering each animal so treated, the name and address of the owner of the animal, and the name of the manufacturer of the biologic used.

Concluding Remarks

In conclusion, we wish to impress upon regulatory officials the necessity of having a definite policy for the prevention, control and eradication of Bang disease before promulgating regulations. Rules and regulations designed to aid in the prevention, control and eradication of Bang disease should be drawn and enforced so as not to penalize or make it a hardship for the owner who is interested in and making a conscientious effort toward the eradication of the disease. Regulatory officials should be practical as well as thorough and use common sense in enforcing regulations and quarantines.

Regulatory officials should do more than this—they should familiarize themselves with the problems of the live stock and poultry industries, so that they will understand the effect of disease control measures upon the development and future welfare of these industries. In other words, in drafting and enforcing laws and regulations designed to prevent, control and eradicate transmissible diseases, regulatory officials should always consider the interests of the live stock and poultry industries, along with the interests of others concerned, otherwise, regulations may be promulgated that will be more injurious in the end than the disease.

We make it a practice in Pennsylvania to submit our proposed regulations to intelligent and interested breeders, leading veterinarians, our Veterinary School and State Agricultural College teaching and extension staffs, farm paper editors, Grange officials, and others interested in the subject covered for the purpose of getting their views and suggestions. This procedure has proved advantageous because first, it enables our Bureau to obtain exceedingly helpful and practical suggestions and, second, it has given those consulted, a part in drafting the regulations and they become more interested than otherwise and lend their influence and support in enforcement.

Most violations are the result of lack of knowledge or failure to appreciate the importance and necessity of the regulations. In this connection, Mr. A. J. Glover, editor of *Hoard's Dairyman*, a member of this association and a close observer in live stock matters, has this to say:

> The subject of handling diseased animals so they will not spread it to all the herd is of great importance and too much cannot be said about it. The difficulty is to get the average man of the farm to comprehend the necessity of quarantine. The veterinarian, as I consider him, does two things—he treats diseased animals and he teaches how to keep them healthy. It is, I believe, the concensus of opinion that it is more important to teach people how to keep animals healthy than it is to be able to treat diseased animals. It is for this reason that I would emphasize proper feeding and sanitation.

Therefore, in organizing to enforce disease control measures the regulatory officials should provide means for giving the regulations wide publicity, so that the public will understand what is required and the reason. Most people will support a proposition if they understand and appreciate its necessity and advantages.

The local practicing veterinarian should be duly considered in any plan or regulations which may be adopted for dealing with Bang disease or other transmissible diseases. Friendly interest and support are essential if any control or eradication program is to be successfully launched.

The local veterinary practitioner occupies an intermediate position between the regulatory officials and live stock and poultry owners. His influence can be used to advantage by regulatory bodies in establishing necessary confidences in disease control and eradication work among live stock and poultry owners. Furthermore, no disease control plan or regulations can be successful without the confidence, cooperation and support of both owners and practicing veterinarians.

The method for handling Bang disease in Pennsylvania, over a period of years, has proved to be effective and we commend it to those interested in the prevention, control and eradication of this disease.

Discussion

President Cary: The first to discuss this will be Dr. C. P. Fitch, of St. Paul, Minnesota.

Dr. C. P. Fitch: A discussion of a paper sometimes means the presentation of another paper. I trust that I shall not fall into that group. I do wish, however, to call your attention to certain evolutionary processes that have gone on in this association during the past two decades.

The problem of the control of bovine tuberculosis has been discussed by this body during that period. In the beginning there was very little to be said in regard to the regulation and eradication of that infection. Each state was left to its own devices in regard to how that disease should be controlled. It was not until 1918 that anything like a uniform plan was adopted, and it was not until several years later that the area plan was formulated and put into operation. I think all of you who are sitting in this room at the present time and who attended a meeting of this association about ten years ago remember that this body refused to recognize bovine infectious abortion due to the Bang organism as an infectious disease. The time has passed when that attitude is held by those in the control of infectious diseases of animals in this country. We have come to recognize that this infection is a transmissible disease and that in many respects it bears close similarities to that of tuberculosis.

Not many years ago the human element had no part in the control program of this infection. This morning we have been told definitely of some of these human contacts, and even yet we do not know what they all are. The time has come when every state or province on this continent should take definite cognizance of the disease due to the Bang organism and initiate in its own respective commonwealth those rules, regulations and laws which are necessary to suppress it properly. Every commonwealth that refuses to do that is standing in its own light, and unless it does make progress it will be in the background in the not distant future.

There were one or two things that were brought out in Dr. Munce's paper that I wish to re-emphasize. One of them is the accuracy of the agglutination test, and other tests used in recognition of this infection; and second, the control of the use of vaccines in handling this disease. We have generally come to view the use of bacterins as relatively inefficient in the control of this infection. They have fallen into the discard pretty largely. Vaccines are used still, but we are not going to control this infection until those products are put under the control of the regulatory officials of the various commonwealths.

Researches have shown that these products, when injected into the animal body, produce spreaders and immune spreaders, such as Dr. Watson spoke of in relation to tuberculosis yesterday, the most dangerous group to be considered in the control of any infectious disease. Finally, this disease is much easier to control, in my opinion, than tuberculosis.

In an experiment which we have run for five years at the University of Minnesota, we have kept two groups of cattle, one infected and one clean, separated by not more than fifty feet, the only essential thing being that there was to be no direct or physical contact between these two groups. We have maintained in the infected group approximately ten animals during this period, and in the clean group about twenty animals of breeding age. During this period of five years, there have been only three infections in the clean group and not a single infection since April, 1926. These two groups of animals are taken care of by the same individuals. No particular precautions are taken such as dipping the feet into a disinfectant by the individuals who take care of them. They are cared for by ordinary farm labor, and, as I told the group the other day, university farm labor is of the most ordinary kind. (Laughter)

All the drainage from the infected group is to the clean group, and in order to prove or to learn something as to the virulence of the infection in the infected group, we placed three animals from the clean group in the infected group last August and September. These three animals have in every instance become infected, two have aborted and one calved ten days early and we isolated the organism from the placenta, indicating the virulence of the disease in the infected herd.

This disease does not spread as readily as does tuberculosis. We have to do something with the infected cow and we believe that the segregation plan for the control of this infection, based upon testing and the production of a clean herd, when such regulations and laws have been instituted, will protect these individuals and is a workable plan and its efficiency has been demonstrated. (Applause)

President Cary: The next is a report of the Committee on Infectious Abortion, by Dr. Ward Giltner, Chairman of the Committee.

. . . Dr. Giltner read the report. . . . (Applause)

REPORT OF COMMITTEE ON INFECTIOUS ABORTION

Part I

Dr. Ward Giltner, *Chairman*, East Lansing, Mich.

Dr. George H. Hart, Davis, Calif. Dr. C. H. Case, Akron, Ohio.
Dr. C. P. Fitch, St. Paul, Minn. Dr. R. R. Birch, Ithaca, N. Y.
Dr. M. F. Barnes, Harrisburg, Pa.

Your committee has been impressed with the importance of two aspects of the bovine infectious abortion problem: the susceptibility of man to the causative microbe and the present status of control of the disease. Rather than include in this report an inadequate treatment of these two subjects, a special program has been provided; and we hereby acknowledge our indebtedness to all those who have participated in the program.

Your committee does not undertake to make any definite statements relative to the danger to public health from Bang's abortion disease, but it is certain that the public is aroused to the possibility of danger so that the control of this disease becomes a more and more pressing problem. It is our judgment that raw milk will not meet with public approval unless it comes from abortion-free herds. Pasteurization is recommended for milk from known infected herds and milk of doubtful origin.

In an effort to throw still further light on the subject of control, your committee has made a statistical study of biological preparations commercially available for curative or preventive treatment of this disease, and incidentally, in certain cases, of its complications. It must remain for another occasion to summarize the results of immunologic investigations by non-commercial research agencies.

A Statistical Study of Biologicals for Infectious Abortion

The Bureau of Animal Industry of the U. S. Department of Agriculture had issued licenses, by 1927, to 24 firms (table I) to manufacture and sell biological preparations for the prevention or treatment of Bang's disease in cattle and swine. These preparations are sera, bacterins, and vaccines although they are designated by 23 different names, most of which are obviously intentional or chance differences in the arrangement of the same descriptive words.* There are only three preparations of sera, 26 preparations of bacterins (including one serobacterin) and 17 preparations of vaccines (including one serovaccine) for cattle and 12 preparations of bacterins for swine. There is one preparation, "abortion mixed bacterin," for which an animal is not specified. Four makers of bacterins (bovine) make two preparations each, one being designated "mixed." The statistics on the manufacture of these products

*The report of the Committee on Veterinary Biologics of the A. V. M. A. (Jour. of the A. V. M. A., Oct., 1928, p. 735) recognizes the chaotic state of nomenclature in this connection.

TABLE I—*Commercial biologics for abortion in cattle and swine*

License Number	Antibovine Abortion Serum	Antiabortion Serum (Bovine)	Bovine Abortion Serobacterin	Bovine Abortion Serovaccine	Abortion Mixed Bacterin (Bovine)	Abortion Bacterin Mixed (Bovine)	Bovine Abortion Bacterin (Mixed)	Bovine Abortion Mixed Bacterin	Mixed Bovine Abortion Bacterin	Mixed Abortion Bacterin (Bovine)	Abortion Bacterin (Bovine)	Antiabortion Bacterin (Bovine)	Bacillus Abortus Bacterin (Bovine)	Bovine Abortion Bacterin	Bacillus Abortus Bacterin	Abortion Vaccine (Bovine)	Bacillus Abortus Vaccine (Bovine)	Bovine Abortion Vaccine	Abortion Mixed Bacterin (Swine)	Swine Abortion Bacterin (Mixed)	Swine Abortion Mixed Bacterin	Mixed Serum Abortion Bacterin	Abortion Mixed Bacterin	Total Products Each Manufacturer
A	x		x	x										x										4
B															x						x			2
C		x														x								2
D																x								1
E						x										x			x					3
F											x													1
G												x				x			x					3
H													x				x							2
I											x													1
J							x							x				x		x				4
K		x			x						x					x			x					5
L										x						x								2
M											x					x							x	3
N								x						x				x			x			4
O									x									x				x		3
P											x					x			x					3
Q											x					x			x					3
R							x											x						2
S					x																			1
T								x										x			x			3
U																x								1
V					x													x	x					3
W					x						x													2
X					x													x	x					3
Totals	1	2	1	1	5	1	2	2	1	1	7	1	1	3	1	10	1	7	7	1	3	1	1	
Grand totals		3		2											25			18				12	1	61

over a nine-year term show that anti-serum for abortion plays a negligible rôle in the treatment of this disease. This is the case also with bacterins for swine abortion. Except for 1927 (table II), the number of doses of bacterins greatly exceeded that for vaccines; but there is a considerable tendency toward falling off in the total output of bacterins, while there is an equally marked rise in the output of vaccines. This situation reflects the commercial interpretation of the general tenor of scientific statements and the advice of some practitioners for the past few years, viz., that bacterins are practically valueless—but not harmful except as they interfere with the type of control work based on the agglutination test; and that certain vaccines may have

TABLE II—*Commercial production of biologics for abortion, 1919-1927*

YEAR	BOVINE ABORTION ANTI SERA (DOSES)	ABORTION BACTERIN (BOVINE) (DOSES)	ABORTIÓN BACTERIN (PORCINE) (DOSES)	ABORTION VACCINE (BOVINE) (DOSES)
1919	1,123	232,600		22,843
1920	1,198	364,545	400	15,353
1921	337	173,611	10,630	22,932
1922	1,126	220,697	11,355	31,909
1923	3,749	120,439	14,479	43,720
1924	3,530	168,494	9,094	74,085
1925	3,316	134,357	5,253	59,785
1926	3,890	260,152	7,039	54,381
1927	4,363	162,207	10,468	193,203

some immunizing power, as indiciated by lowering the abortion rate, although they sometimes do collateral damage.

A study of commercial biologics for Bang's disease shows that (table III), as far as claims are concerned, there is a tendency toward modesty—recommendations rather than claims are made. Most of the preparations are frankly for preventive treatment only, but mixed bacterins are offered for their curative powers also. There is a wide variation in sources of cultures and in methods of manufacture of the different products. If there is a *best*, it is obvious that not all the manufacturers are using the *best*.

As far as concerns reliable statistical data to prove the value of these preparations, none are presented.

There does not appear to be oneness of mind in respect of the desirability of using avirulent cultures for vaccines or of the danger from virulent cultures.

Your committee cannot recommend serums or bacterins as giving much promise in the control or treatment of this disease, nor can we recommend vaccines except for experimental study.

We are not ready to recommend vaccines as a part of the control program of this disease, but we do feel that they offer a very hopeful field for investigation under proper supervision and we recommend that government appropriations for such studies be made.

THE PRESENT STATUS OF LEGAL CONTROL OF BOVINE INFECTIOUS ABORTION

Table IV gives the results of a questionnaire addressed to all the responsible state authorities to whom we hereby acknowledge our appreciation for their courteous replies. The following questions were asked:

1. What laws or regulations now prevail in your state?
   (a) Specifically for the control of Bang's disease.
   (b) General laws or regulations.
2. To what extent are these enforced?
3. To what extent do they offer protection against the disease?
4. What new laws or regulations do you want, to make the control of this disease effective in your state?
5. To what extent is it your hope that this disease may be controlled without laws or regulations?

It is obviously very difficult to summarize the results of such a questionnaire in such a way that a definite concensus of live stock sanitary opinion may be presented to you with our recommendations. The tabulation will undoubtedly mean different things to different interpreters. It seems to your committee that there is a growing interest in specific state legislation or in a realization that general legislation may and must be used to control Bang's disease. The evidence presented in the table shows that regulatory officials are not ready for uniform legislation or regulations to control this disease. There is enough evidence of failure to enforce specific legislation and of reluctance to use general legislation to support their position. Of course, legislation is feeble pro-

TABLE III.—*Report of questionnaire sent to licensed manufacturers*

Firm	Preparations Made	Claims for Curative or Preventive Power	Description of Manufacture	Extent of Proved Beneficial Action	Are Live-Culture Vaccines Virulent?
A	Anti-bovine abortion serum	*No definite claims for any product.* Imparts a passive immunity.	From cattle hyperimmunized with 6 different strains of living *B. abortus*	No reliable statistical evidence	
	Bovine abortion serobacterin	To meet demand of those reluctant to use a live culture vaccine	Single strain grown on neutral glycerin-agar. Purity tested; killed by heat. Standardized, sensitized with anti-abortion serum		Do not use virulent culture. Considered dangerous
	Bovine abortion serovaccine	For use in infected herds; better than bacterin	Similar to above. Not killed		
B	Bacillus abortus bacterin	Sold as prophylactic	Cultures from cases grown in special potato bouillon; killed chemically	No data on efficiency; one of largest selling products; field reports indicate value	
C	Abortion vaccine	No curative. On all females in infected herds, will reduce abortion rate to 5% or less. Simultaneous treatment for non-infected pregnant animals and valuable pregnant cows	Not divulged — different from any ordinarily employed	Unable to give reliable statistical evidence. Some favorable statistics submitted	Avirulent
	Anti-abortion serum		Hyperimmunizing horses		

TABLE III.—*Continued*

Firm	Preparations Made	Claims for Curative or Preventive Power	Description of Manufacture	Extent of Proved Beneficial Action	Are Live-Culture Vaccines Virulent?
D	Abortion vaccine (Bovine)	Preventive only	Complete description of both preparations submitted		Still experimental
	Three-injection method of killed cultures	For pregnant animals, value not emphasized	Pure culture of *B. abortus* trikresol-killed; standardized and purity checked		To cattle no knowledge of bad effects
	Single-injection method of live organisms	For badly infected herds, on non-pregnant cows and virgin heifers	Purity and identity established; standardized	Favorable reports from veterinarians	
E	Abortion bacterin mixed (bovine)				
	Abortion vaccine (bovine)				
	Abortion mixed bacterin (swine)				
F	Abortion bacterin (bovine)				
G	Antiabortion bacterin (bovine)	For the preventive treatment of contagious bovine abortion	Killed at 60° C., 1 hr., 0.5% phenol added; 2 yr. potency	Have reports only from vets. the majority of whom claim desired results are obtained	

TABLE III.—*Continued*

Firm	Preparations Made	Claims for Curative or Preventive Power	Description of Manufacture	Extent of Proved Beneficial Action	Are Live-Culture Vaccines Virulent?
G	Abortion mixed bacterin (swine)	For the preventive treatment of porcine contagious abortion and its complications	*B. abortus*, 50%; Staph., 25%; Streptococci, 25%; all of porcine origin. One dose of 10 cc		
	Abortion vaccine (bovine)	For the prevention of contagious abortion of cattle, for use on virgin heifers and non-pregnant cows in affected herds	*B. abortus* of bovine origin grown in beef extract broth at pH 7.5; to be used within 4 months		Virulence not known at time of use. No serious results on cattle injected 60 days before breeding
H	Bacillus abortus bacterin (bovine)	May be employed with safety for infected cows during pregnancy		Reports very indefinite; recommended as being only thing available for infected pregnant animals	
	Bacillus abortus vaccine (bovine)	Recommended for active immunization of cows in infected herds	Cultures from field cases; good antigenic value. No attempt to attenuate. A whole culture vaccine, not a suspension in saline	From general reports, very successful in controlling losses	Seen no evidence of spread of infection from use of vaccine
I	Abortion bacterin (killed culture)	Prophylaxis—3 doses to establish a strong immunity, given two weeks before animal is bred	Seven strains of *B. abortus* (2 from B. A. I., 4 from an expt. sta., 1 from vaginal discharge of cow). Purity established; grown on gelatin-hormone-agar; devitalized by heat (not killed), trikresol added and sterility determined. Toxicity tests on animals	Cannot tell to what extent it gives satisfaction. Steady demand	

TABLE III.—*Continued*

Firm	Preparations Made	Claims for Curative or Preventive Power	Description of Manufacture	Extent of Proved Beneficial Action	Are Live-Culture Vaccines Virulent?
J	Bovine abortion bacterin (mixed)	No outstanding claims. No exaggerated statements. Should be administered to pregnant cows to stimulate resistance against abortion infection and metritis	General routine methods. *B. abortus*, 90%; streptococci, 4%; staphylococci, 1%; *B. coli*, 1%	Nothing official; letters state results good	
	Bovine abortion vaccine (live culture)	An immunizing agent to be used on virgin heifers and non-pregnant cows in infected herds	Non-virulent culture of live *B. abortus*, tested for virulence and antigenic powers; grown on liver broth. Cultures from various sources	Nothing official. Letters state results good	Non-virulent
K	Abortion mixed bacterin (bovine)	No claims	Pure cultures of *B. abortus*, *Staph. albus* and *aureus*, *Str. pyogenes*, *B. coli* (all of bovine origin); grown on solid media, tested for purity and standardized, killed with 0.3% trikresol	Reports from customers generally satisfactory	
	Abortion bacterin (bovine)	No claims	*B. abortus* culture (see above) 3 injections	See above	
	Abortion vaccine (bovine)	Used only in infected herds on virgin heifers and non-pregnant cows, at least 2 months before breeding. No claims	See above. Culture not killed. One injection	See above	Non-virulent. No report of danger

TABLE III.—*Continued*

Firm	Preparations Made	Claims for Curative or Preventive Power	Description of Manufacture	Extent of Proved Beneficial Action	Are Live-Culture Vaccines Virulent?
M	Mixed abortion bacterin (bovine)	Recommended for pregnant cows where abortion exists Promise it will save enough calves to pay for its use	*B. abortus* grown on beef-broth glycerin-agar, washed off with culture of *B. coli* and killed at 60° C. for one hour		
	Abortion vaccine (bovine)	Promise successful results in 94% of aborting cows following first treatment. Use on open cows in infected herds 60 days before breeding	Grown as above. Wash off with 0.85% NaCl solution Must stimulate agglutinins in 25-cc dose. Prepared only as ordered, to be used within 10 days	In local dairy herds and range cattle, results 100% perfect. No bad results	Virulence not tested. Do not recognize danger from virulent cultures in infected herds
P	Abortion bacterin (bovine)	Not based on own experiments or on field tests but on statements by authorities			
	Abortion mixed bacterin (swine)				
	Abortion vaccine (bovine)	For use only in herds where positive diagnosis has been made			Do not believe abortion vaccine free from danger
R	Bovine abortion bacterin (mixed)	Convinced it has merit in reducing abortion and mitigating cotyledonitis and placentitis if properly used	For 5 each of strains of *B. abortus*, *B. pyogenes*, *B. coli*, *Staph. aureus*, *Staph. albus*, and streptococcus from B. A. I. west and northeast, grown on agar, washed off with saline and killed; purity tested and bacteria count checked	Personal trials such that it is conscientiously recommended	

TABLE III.—*Continued*

Firm	Preparations Made	Claims for Curative or Preventive Power	Description of Manufacture	Extent of Proved Beneficial Action	Are Live-Culture Vaccines Virulent?
R	Bovine abortion vaccine	None. Refer to work of research men	Strains from B. A. I., west and northeast, grown in dextrose agar, washed off with saline; bacteria count standardized		No evidence that live culture vaccines are dangerous
S	Abortion mixed bacterin (bovine)	For prevention of contagious abortion and prevention and treatment of accompanying infections of udder, womb, etc. Particularly adapted for use in garget and similar conditions	Standard methods of bacterial vaccine production are followed	Quite beneficial for purposes stated—particularly in mammary and uterine infections	Live culture vaccines regarded as dangerous; always found them to be dead
V	Bovine abortion bacterin	Indicated for immunization of cattle against infectious abortion, due to *B. abortus*, and metritis	*B. abortus*, 80%; *Str. pyogenes*, 6%; *B. coli*, 6%; *Staph. albus*, 4%; and *Staph. aureus*, 4%; grown in bouillon. *B. abortus* grown 14 days and formalin killed. Sterility test	No evidence checked by controls of personal tests on either product—only information is from field results (not given)	
	Live culture abortion vaccine	Indications: for the prevention of abortion in cattle; to be used on virgin heifers and non-pregnant cows, 60, or better 90, days before breeding	*B. abortus* grown in bouillon for 14 days	See above	No evidence that cultures (virulent) are not dangerous. Use has not demonstrated that this product is dangerous

TABLE III.—*Continued*

Firm	Preparations Made	Claims for Curative or Preventive Power	Description of Manufacture	Extent of Proved Beneficial Action	Are Live-Culture Vaccines Virulent?
W	Abortion bacterin	For prevention and treatment of cattle abortion	Strains from B. A. I. and infected herds recently isolated. Grown on horse bouillon medium. pH 7.6-7.8, in triple distilled water. Standard methods of preparation. Packed in alkali-free glassware	No individual evidence; large quantity furnished, not a single complaint	Live cultures not used. Helpfulness not fully determined. Some states prohibit their use without special permit
	Abortion mixed bacterin (bovine)	Useful in prevention and treatment of mastitis and metritis following abortion	*B. abortus*, 35 billion; *Str. hemolyticus* and *viridans*, 10 billion; *Staph. aureus* and *albus*, 5 billion; *B. coli*, 5 billion; *B. pyogenes*, 5 billion (bovine strains)		
X	Abortion mixed bacterin (bovine)	Recommended in herds where infection is not extensive—in pregnant animals	*B. abortus*, 50%; Streptococcus, 15%; *B. coli*, 15%; and Staphylococcus, 20%; grown in beef peptone for 6 weeks or more; killed by heat (58° C.) or chloroform suspension method. Preserved in .5% phenol; 20-cc single injection or 4, 6, and 10 cc at week intervals. Tests for freedom from contamination	Three-quarters of veterinarians report good results (combined with sanitary, surgical and medical procedure), both as preventives and curatives. Live cultures produce only slightly higher degree of immunity. Complications following abortion are reduced	
	Abortion vaccine (bovine)	Recommended in badly infected herds in non-pregnant animals only	Grow low-virulency cultures in beef peptone bouillon for about one week. Titration of media important. Culture should contain 20 billion bacteria per cc	See above	Low virulence. Does not produce permanent reactors on abortion disease in young animals in infected herds. Feel product is not dangerous

TABLE IV.—*Report of state questionnaires*

STATE	WHAT LAWS OR REGULATIONS NOW PREVAIL IN YOUR STATE?	TO WHAT EXTENT ARE THESE ENFORCED?	TO WHAT EXTENT DO THEY OFFER PROTECTION AGAINST DISEASE?	WHAT NEW LAWS OR REGULATIONS DO YOU WANT, TO MAKE THE CONTROL OF THIS DISEASE EFFECTIVE IN YOUR STATE?	TO WHAT EXTENT IS IT YOUR HOPE THAT THIS DISEASE MAY BE CONTROLLED WITHOUT LAWS OR REGULATIONS?
Alabama	No regulations to control or regulate this disease		Tested 825 blood samples, 670 gave negative reaction, 155 positive	Hope to adopt plan similar to Pennsylvania plan	
Arizona	None			Uniform state regulations	Control cannot be effected without rigid laws and regulations
Arkansas	General stock laws	Almost 100%	To counties released from quarantine. Educate farmers to buy young stock	Any practical working plan	Only in herds of educated farmers
California	General disease control laws for prevention, control, eradication of transmissible diseases	Supposed to prevent entrance and spread of transmissible diseases	Restrict movement of infected cows; measures for eradication	A specific enabling act	It is hoped but not anticipated
Colorado					
Connecticut	Importation, inspection, quarantine, and condemnation of cattle		Subordinated to tuberculosis control.	New rules to be adopted later	Situation now requires definite control by statute
Delaware	Delaware accredited herd plan	Not compulsory	To owners desiring it.		

TABLE IV.—*Continued*

STATE	QUESTION 1	QUESTION 2	QUESTION 3	QUESTION 4	QUESTION 5
Florida	General. Authorize S. L. S. S. Board to control infectious diseases	Not at all	Authorize tests of cattle, disposition of cattle	Additional laws would not be necessary	Not at all
Georgia	Cont. abort. test. Identification of animals. Quarantine	Only in interstate shipment	Only in interstate shipment	Laws applying to intrastate shipments	Can not be controlled without regulations
Idaho	None		None	In process of formation	Must have state-wide plan of control backed by laws
Illinois	None as yet			Regulations are formulated	
Indiana	None especially for abortion		General powers to control infectious diseases		Very little
Iowa	No laws as yet			Expect to make legislation on the question this winter	
Kansas	None. In cases of abortion the live stock sanitary commission orders segregation of infected animals			None until an effective medicine or serum is found	
Kentucky	None. However Board has authority to pass regulations				

TABLE IV.—*Continued*

STATE	QUESTION 1	QUESTION 2	QUESTION 3	QUESTION 4	QUESTION 5
Louisiana					
Maine	Only general health laws			None unless a less cumbersome test is devised	
Maryland	No specific regulations			Controlled transfer of infected animals has been proposed	
Massachusetts	No laws or regulations pertaining to this disease		Division examines samples of blood free	Certain rules. Establishment of abortion-free accredited herds	
Michigan	Only general animal disease laws	Not rigidly	Little because they are not enforced	None until sentiment is stronger	Laws will be necessary later
Minnesota	No laws. Rules for testing cows, agreements between owners and Board		To a very limited extent	None	Blood tests and eradication from each herd may give practical results
Mississippi	None			Do not know where to start	No hope
Missouri	Unlawful to sell cattle affected with inf. abortion	No occasion to test it out as yet			Only when more is learned aobut the disease

TABLE IV.—*Continued*

State	Question 1	Question 2	Question 3	Question 4	Question 5
Montana	No sale of infected animals. May be placed under quarantine. No infected animal bred within 60 days of aborting. Fumigation	Not much as yet	Should keep non-infected herds free from infection	Contemplating accredited herd plan	Building up of abortion-free herds separately
Nebraska	General disease laws			Have found no successful one yet	
Nevada	General disease control laws		All that could be expected from such a source	None	Education of individuals is quite satisfactory
New Hampshire	General law. No rules or regulations	Not enforced	Do not think it would furnish any protection	Do not know	Something must be done about new laws
New Jersey	Test herds. Quarantine infected cows or slaughter them. Mark infected cows. Report tests in 7 days		Large number of private herds and institutional herds under supervision	Require all animals coming into state to enter on a certificate	Disease cannot be controlled without laws
New Mexico	Brand laws	100%		This is a range state so the less laws covering abortion the better	
New York	None on abortion			Experimental work at N. Y. S. Vet. Col.	

TABLE IV.—*Continued*

STATE	QUESTION 1	QUESTION 2	QUESTION 3	QUESTION 4	QUESTION 5
North Carolina	Quarantine. Control by Commissioner of Agr. Health certificate for imported cattle	Quarantine not practiced much. Health certificate, rigid enforcement	Prevents diseased animals from coming into state	Federal regulations	Laws necessary only for interstate shipment
North Dakota	None			Expect to make regulations at next meeting of Board	Limited
Ohio	No laws. Plan for prevention, control, and eradication of abortion	Plan in cooperation with owners		Reporting blood tests, restricting reacting animals from non-infected herds enforcable	Cannot be controlled without laws
Oklahoma	None. State Board of Agriculture has power to make rules and regulations for handling contagious abortion			Statute to enforce these regulations. Appropriations for investigation	Do not think it can be controlled without laws
Oregon	No laws. Cooperative plan	None. Those who wish to may sign agreement	Abortion free herds may result	None	Free areas developed. Designated areas. No results before 5 years
Pennsylvania	General law. Disposition of infected animals intrastate shipment, blood samples, use of biologics proscribed; and Pennsylvania plan			Requirement of blood tests and health certificate	
Rhode Island	No laws			Voluntary agreement among herd-owners	

TABLE IV.—*Continued*

STATE	QUESTION 1	QUESTION 2	QUESTION 3	QUESTION 4	QUESTION 5
South Carolina	Forbid shipment into state without negative agglutination test	Splendid cooperation by transportation companies	Prevents importation of cattle affected with disease	U. S. B. A. I. to cooperate, as they are doing in control of tuberculosis	None
South Dakota	None			Public sentiment not great enough	Veterinarians and owners should cooperate more
Tennessee	None	No effort being made in this state to eradicate contagious abortion. Lack of assistants and funds		None specifically	Little
Texas	The Pennsylvania plan	In such herds as have undertaken this work.	Only inaugurated a few months ago	None	Owners handle their own herds
Utah	Board of Agr. has power to make rules and regulations	None now		State laboratory. Perhaps the Pennsylvania plan	Not at all. But education and cooperation with owners necessary
Vermont	Free testing of suspected animals				
Virginia	Prohibit entrance of contagiously infected animals	Not at all	None	Prohibition of interstate shipment and any sale of infected cows	Cannot be controlled without laws

TABLE IV.—*Continued*

STATE	QUESTION 1	QUESTION 2	QUESTION 3	QUESTION 4	QUESTION 6
Washington	General disease control laws	Not enforced	Would offer protection if enforced	Right to quarantine against diseases; prevent interstate shipments of infected animals	Cannot be effected without laws
West Virginia	None. A laboratory for diagnosis of this disease has just been established			Soon, some regulations will be adopted	
Wisconsin	Prohibits sale or transportation of diseased animals within state		Has not yet been applied to abortion disease	Doubt that any are needed	Realization of economic importance, and education will do more
Wyoming	None	None	None	Any that are practical and effective	Cannot be controlled without laws or regulations
Hawaii	All incoming cattle must have passed agglutination test	Fully enforced	Not much. Several abort while in quarantine and afterwards	Haven't given it much consideration	Not very great

tection in the absence of enforcement, but there is evidence that some restrictive measures are valuable, aside from standing as a threat. Restrictions on the movement of affected cattle can be partially enforced legally, but only in so far as there is available satisfactory diagnostic machinery.

(Signed) WARD GILTNER, *Chairman*
(Signed) C. H. CASE
(Signed) M. F. BARNES
(Signed) C. P. FITCH
(Signed) R. R. BIRCH
(Signed) G. H. HART

PRESIDENT CARY: We have another report from this Committee. It has been requested by the Chairman of the Committee that Dr. R. R. Birch, of New York, be given a chance to give this report. Dr. Birch. (Applause)

DR. BIRCH: The situation is exactly this: The report which has been presented is analytical in nature and when the study was made we thought that the results of the study should be made known to the Association. All the members of the Committee except one, Dr. Giltner, thought we should take certain specific things from our knowledge, which we regard as sound and which we know are well supported, so that those, who come here for a summary of useful information which they can take home with them, may have something such as that presented.

There are not two reports and this is not a minority report. This is a report which is signed. All that Dr. Giltner presented is subscribed to by all of the members of the Committee except Dr. Hart, who did not have the opportunity to examine the last correction. The report which I shall now read is subscribed to by all members of the Committee except Dr. Giltner, who declines to accept it, and Dr. Hart, who has not had an opportunity to go over the report. This is a majority report, four members have signed it and one will probably sign it and one declines to sign it.*

. . . Dr. Birch read part II of the report. . . .

REPORT OF COMMITTEE ON INFECTIOUS ABORTION

Part II

Attention is called to the following well-supported facts regarding Bang abortion disease:

1. It is now a controllable disease.
2. The serological tests are sufficiently accurate to serve as a basis for freeing herds of the disease.
3. Clean herds, so indicated by the agglutination tests, carefully applied and interpreted, can be maintained clean year after year.
4. Herds thus maintained show a breeding efficiency far above that which is recorded in herds which contain many animals that react to the serological tests.
5. Other things being equal, herds that are entirely clean are the best breeding units that can be obtained. Those that consist entirely of reactors, carefully culled, can be made to show fair breeding efficiency. Those consisting of reactors and non-reactors *in association* show a minimum breeding efficiency as compared to the two other groups.
6. Clean units may safely be recruited with young stock from infected units provided the serological tests are made the basis of the transfer. Thus the infected unit may often be made to serve as a source of some income until the clean unit can be established, and the blood lines that the breeder prizes can easily be perpetuated.
7. Testing Bang abortion disease out of a herd or unit and keeping it out is the only known, successful way to handle it.

*The report was submitted to Dr. Hart, after the meeting, and was approved by him.—Editor.

To sanitary boards or officials in the various states which support a large cattle population, especially the dairy states, we recommend:

1. That provision be made for conducting and interpreting the serological tests by careful and experienced men.
2. That provision be made for the accurate recording of consecutive tests in pure-bred herds or in others in which identification of animals is satisfactory.
3. Recognition of the fact that the clean herd or unit, and not the area, is the basis of any effective start in the control of the disease.
4. Recognition of the fact that each herd is an individual problem and that while the ultimate goal in all herds—the clean unit—is the same, the immediate plan of handling is contingent on such considerations as the number and value of the reactors, the equipment available, the size of the herd, and many others.
5. The use of the practicing veterinarian as the most essential part of any plan of control, because he is the only one in a position to handle each herd as an individual problem.
6. A sanitary code which permits the sale of reactors into herds of known reactors, provided the status of the purchased animals is made known to the purchaser.
7. Recognition of the fact that a clean test of an individual which comes from an infected unit, or a unit of unknown status, is a meager guarantee of safety to the purchaser.
8. Recognition of the fact that the placing of clean cattle into an infected herd is usually disastrous and serves to discredit the serological tests in the eyes of the purchaser.
9. A general policy of helpful guidance to the breeder who is endeavoring to establish and maintain a clean herd rather than a policy which involves authority on quarantine, and the erection of too many official barriers built on new knowledge which few breeders as yet fully understand.

To the individual cattle-breeder, we recommend:

1. Raising of his own cattle just as far as possible, and the ultimate goal of establishing and maintaining a herd free from Bang abortion disease.
2. That he test his herd so as to learn its true status and thus be enabled to know which animals are dangerous to their associates, and to weed them out if they are limited in number.
3. A policy of severe culling in reacting units so that only valuable animals are retained.
4. Keeping reactors and non-reactors entirely apart.
5. A general plan of herd management which involves the raising of heifers apart from mature animals.
6. The use of maternity stalls, if possible, for all cows at calving time and provision for relatively small units which are now habitually recruited from outside sources.
7. That additions to any clean herd or unit should consist of non-reacting individuals that come from clean herds, and that the transfer shall be made just as far as possible while the females are not pregnant.
8. The employment of a thoroughly qualified veterinarian whose services are necessary in laying out a specific plan of handling suited to the individual herd; drawing blood samples for the serological tests; the interpretation of the reaction; the handling of individual cows which fail to breed; making pregnancy examinations, and other services of like nature.

To the practicing veterinarian who must assume the lion's share of the responsibility in helping breeders to establish and maintain herds free from Bang abortion disease, we recommend:

1. That he thoroughly familiarize himself with the newer knowledge regarding the disease, so that he is equipped to draw blood samples required in making the serological tests; to interpret the test-charts

and relate each test to the handling of the individual concerned; and to guide the breeder in the direction of a clean herd.

2. That he courageously refrain from recommending to his clients easy palliative measures which "may do some good" in preference to more difficult ones which are known to be successful.

(Signed) C. H. Case
(Signed) M. F. Barnes
(Signed) C. P. Fitch
(Signed) R. R. Birch
(Signed) Geo. H. Hart

Dr. Birch: Mr. President, I move the adoption of the entire report.

President Cary: Do you mean the adoption of the report as read?

Dr. Birch: I mean the adoption of the report as read by both. They are integral parts of the report and they are a majority report, the only difference between the two parts being that Dr. Giltner failed to subscribe to part II.

. . . The motion was seconded. . . .

President Cary: A motion has been made and seconded that we adopt the entire report. The question is now open for discussion.

Dr. F. B. Hadley: I think this is an excellent report, especially the part read by Dr. Birch, because it puts in rather concrete form definite recommendations for the owner, for the veterinarian, and for others particularly interested.

In speaking for the Committee on Abortion of the A. V. M. A., as it was constituted last year, I want to especially commend the present committee for using the term "clean herd" or "clean unit" in place of the term which we have inadvisedly used and that is "abortion-free herd" or "abortion-free unit," for the reason that we all know, as we get further into the study of the abortion problem, that there is no such thing as an "abortion-free herd" or "abortion-free unit." The use of these terms has led to misunderstanding on the part of the herd-owner, because no matter how often you apply the agglutination test for abortion in the herd, and no matter how you endeavor by all the means available to keep abortions out of the herd, you are going to have occasionally up to as high, possibly, as five or maybe eight per cent of abortions in a herd, even though it is free as far as the agglutination test for infectious abortion goes.

By way of introducing this subject for discussion, I want to make these remarks and to add my support to the Committee for their careful study and compilation of these essential features.

Dr. Connaway: I wish to commend this report as a distinct, progressive step. Men have been coming here from all parts of the country year after year to take back home with them something that they could do and many of them have gone away disappointed because the Committee has been going around in circles. This is getting up to practical applications, which some of us know can be carried out, and the paper which Dr. Munce read has touched upon these things so very, very fully that very little more can be said.

This last report is rather a summation, is definite and is in concrete form, which will focus the attention of sanitary officers on what should be done. I am very sorry, indeed, that our friend Mr. Glover could not have been here to take part in this discussion and to have heard these reports, for some of you may recall that not more than three or four years ago, when I proposed some measures which appeared to be very radical at that time and which some of you may yet think are very radical, he called me to task in a very severe manner, and I think if he were here today he would come to the mourners' bench and say that I was right.

We have to recognize that this is a disease very comparable to tuberculosis, as far as its transmission from one state to another is concerned. I recall that when Dr. Cotton, of the B. A. I. Experiment Station, and I were asked to go down to Georgia to discuss this matter before an association of dairymen and veterinarians, after we had talked about the nature of the disease, its infectiousness and methods of control applicable to farm handling of it and saying not one word about quarantines, Dr. Bahnsen put on a quarantine. I tried at

that time to get him to defer that until he could discuss that matter with members of this association, for I felt that it was rather a matter for federal action, or at least the action of a large number of states concurring in a definite program, more than for individual states to take up, and I still have that feeling. Down in my own state I have not been pressing interstate control because I have hoped that this body and the federal government would recommend the interstate control of this disease, just as they do in the case of tuberculosis. But other states are not going to wait for us. After one state has taken this up, South Carolina, Arkansas, New Jersey, Pennsylvania, North Carolina and Oregon have taken it up and are quarantining against other states.

One of the reasons we should quarantine is this: It is very significant (and I am quoting Mr. Glover's words in the discussion of tuberculosis) that it took a long time for some of these states to make up their minds that it was an infectious disease, which should be quarantined against. As a result, some of the breeders of his own state simply unloaded their stuff over into other states. Wisconsin has done that same thing for Missouri, in the case of abortion disease. (Laughter) I wanted him to hear that. Our breeders, in spite of my trying to hold them back until all the states are convinced that this is a good thing, that is the Holstein Breeders' Association at its last meeting, without any suggestion from me, presented a resolution asking that a bill be presented in the Legislature to quarantine against all infected animals from other states, or that the test be required for admission into the State, just as in the control of tuberculosis.

When I heard of that I said, "You are going about this in the wrong way. The Legislature is not the place to go. You have a live stock sanitary board. (In our state we call it the State Board of Agriculture.) Those are the people to whom you should go. They have the power to do this. It does not require a prolonged discussion of this matter in the legislature." So they followed my suggestion and at the last meeting of our State Board of Agriculture a committee was there to bring that matter before them. The secretary of the Board asked me to come to the meeting and say what I had to say about it. I told them what my attitude had been in regard to this. At the meeting this other man presented the matter. Dr. Wilson and I sat back and said nothing. We thought we would hear what this man had to say. After he presented his own troubles that he had had, relating how he had gone to Wisconsin and had brought in stuff and spread the disease among his neighbors and asking that the Board give them relief in this matter, two members of the Board said this: "This is the most important thing that has been brought before this Board for a long time and it is a matter that we must consider." So the matter is under consideration by that board and the State Veterinarian. (Applause)

Dr. Hadley: I have to reply to this charge by our friend from Missouri. He is right and so is Mr. Glover. Mr. Glover is not here to defend himself so I feel duty bound to take one minute of your time. Dr. Connaway quoted Mr. Glover's remark from yesterday, saying that for many years a neighboring state had been the outlet for our tuberculous cattle. That was because they did not believe in the tuberculin test. For some years in the past (not at present, I am sure) the same has been true about abortion-infected cattle. We have been testing cattle in Wisconsin for almost twenty years and Missouri has just come to realize that the test was of some value. (Laughter) The same is true of what other states are doing. "We don't want your abortion-infected cattle," you say. All right. Don't take them. We offered them to you before and you said there was nothing wrong with them and now that you are finding out that you were wrong, we can't help it if you have gone out on the market and bought some rotten apples. (Applause)

Dr. Connaway: I rise to a point of personal privilege in the defense of Missouri and to place things historically right. You know that Missouri is one of the first states that advocated and applied this abortion test, back in 1912. I think that goes a little further back than Wisconsin. (Laughter)

President Cary: Let us confine this discussion to the question.

. . . The motion was put to a vote and carried. . . .

PRESIDENT CARY: The motion is carried and the two parts of the report are adopted.

DR. N. S. MAYO: Mr. President, I move that this report be distributed as soon as possible, by the Secretary, to the authorities of the various states.

. . . The motion was duly seconded, put to a vote and carried. . . .

DR. BIRCH: For fear that it would get into the records wrong, I want to draw attention to the fact that this is a single, majority report.

PRESIDENT CARY: At this time we shall go to the subject of "Mineral Deficiencies in Swine Rations," by Dr. H. H. Mitchell, Chief in Animal Nutrition, University of Illinois, Urbana, Illinois.

. . . Dr. Mitchell read his paper. . . .

MINERAL DEFICIENCIES IN SWINE RATIONS

By H. H. MITCHELL, *Urbana, Ill.*

Chief in Animal Nutrition, University of Illinois

It would seem to be a good general practice, in the business of hog production, to balance the rations used insofar as possible by the proper selection and combination of available feeds, on the basis of their individual nutritive values and of their prevailing prices. By such a procedure, in the large majority of cases, rations suitable for optimum functioning of the animal can be devised without resorting to the use of inorganic supplements, or mineral mixtures, or commercial vitamin concentrates, costing in general much more than home-grown, or even by-product feeds. Swine rations are largely composed of grains, and in this part of the country they are largely composed of corn.

Whole grains possess certain generic nutritive deficiencies, which have been fairly definitely characterized by the nutrition investigations of the last twenty years. It appears that grains are always deficient in protein, calcium and sodium, and that they are probably on the border-line with regard to chlorin. In certain sections of the country they are undoubtedly deficient in iodin also. Grains other than yellow corn are deficient in vitamin A, generally to a marked extent, while all grains appear to be deficient in vitamins C and D, although the deficiency in vitamin C is of no consequence, since swine do not seem to be susceptible to nutritional scurvy. Other deficiencies may, of course, be shown to exist by future investigations.

The balancing of swine rations is based upon the existence of these known deficiencies of corn and other grains. By the use of milk by-products, packing-house by-products, legume pasture or legume hay, and by the use of some of the mill by-products and of the by-products of the vegetable-oil industry, the nutritive

deficiencies of corn and other grains may be entirely corrected or greatly alleviated. However, there will arise many occasions in which the mineral deficiencies will not be entirely corrected, either because of the difficulty in obtaining the necessary supplementing feeds, or because of their relatively high cost, or because of the accentuation of the mineral deficiencies of grain rations during periods in the life of the pig, when its requirements are greatly intensified, particularly during the last weeks of gestation and the duration of lactation. Under these conditions, the feeding of mineral supplements is indicated, and may be expected to be profitable.

With this very general description of the conditions under which the feeding of mineral supplements is advisable, let me proceed to a consideration of what supplements may be used to the best advantage in the light of available information. The deficiency of grains in sodium and possibly in chlorin is adequately and cheaply taken care of by sodium chlorid, or common salt. The free offering of salt to swine under all conditions of feeding is a practice that may be justified on three grounds. In the first place, corn[1] and wheat[2] have been proven to be deficient in sodium, if not in chlorin, and the other grains, of similar composition with respect to these elements, may be similarly described. In the second place, the by-product feeds, with which corn and the other grains are fed, have a variable content of sodium and chlorin, generally greater than that of the whole grains, but not known to be sufficiently great to supplement the grains effectively in the amounts in which they are used. And in the third place, salt has considerable value as a condiment, tending to stimulate the appetite of swine for feed, or for other mineral compounds with which the salt may be mixed.

Calcium (or lime) supplements to swine rations are advisable except when the latter contain liberal amounts of tankage, skim milk, legume hay or pasture, or feeds of equivalent calcium content. A large variety of calcium supplements are available, varying widely in price. These consist largely of carbonate or phosphates of calcium, and since whole grains are not known to be deficient in phosphorus for swine[3] and the usual supplemental feeds even less so, the particular salt of calcium to use does not appear to be a matter of great moment. The bone preparations, particularly steamed bone meal, have been repeatedly shown to be valuable calcium supplements, but because of their high cost, considerable attention is being given to the possibility of using the

cheaper mineral supplements. Of these, the limestones and marls are valuable.[3,4] Even dolomitic limestones, containing magnesium carbonate up to 40 per cent, have been found to be good calcium supplements, though not so good as non-dolomitic limestones. It is known that an increased magnesium intake will decrease the availability of calcium, recent experiments[5,6,7,8] affording strong support for this view, but nevertheless Hart, Steenbock and Morrison[4] have reported good utilization of the calcium of dolomitic limestones by swine, as well as by dairy cows and chickens. The Ohio Station has had a similar experience.

The rock phosphates have been used as calcium supplements to swine rations with varying results, generally adverse. In the most extensive experiments that have been reported, Forbes and his associates,[3] in 1921, proved that, although the calcium of rock phosphate was retained to some extent by growing swine, the bones produced on rations thus supplemented were actually weaker and softer than the bones produced on the unsupplemented ration of seeds and seed products. The comparatively soft and weak bone produced by rations containing rock phosphate suggests that the mineral contains something exerting a deleterious effect on calcium utilization. It has been known for some time that rock phosphate contains considerable amounts of fluorin, probably in the form of a double salt of calcium fluorid and tricalcium phosphate.

It is known also that fluorids are toxic[9] and that their presence in the diet, above certain minimal concentrations, may deplete the bones of their calcium[10] and interfere with the normal development of the teeth. It is probable, therefore, that the fluorid content of phosphate rock detracts from its value as a calcium supplement for live stock, and that when fed above a certain minimum amount it may exert a distinctly toxic effect, as has been shown for both swine and cattle at the Wisconsin Station,[4] and for cattle at the Michigan Station.[11] It has been claimed that certain commercial brands of phosphate rock are better than others for the feeding of live stock, because of a much lower content of fluorin.

In a recent publication[12] by Jacob and Reynolds, of the Bureau of Chemistry and Soils, at Washington, the results are given of a large number of fluorin analyses on phosphate rock from all of the important mining centers of the country. These analyses show clearly that the content of fluorin varies from 3.25 to 4.25 per cent, that Florida samples average somewhat higher than samples

from Tennessee (3.94 per cent as compared with 3.67 per cent), but that washing the rock tends to increase rather than decrease the concentration of this constituent. Among the Tennessee samples, the ratio of phosphoric acid to fluorin was fairly constant.

On the basis of these facts, the use of raw rock phosphate as a calcium supplement to swine rations seems inadvisable. It is unsafe until something more definite is found out concerning the effects of variable amounts, and in any case raw rock phosphate has not proven to be so efficient a source of calcium as the limestones.

Acid phosphate or superphosphate, prepared for use as a fertilizer, has been suggested as a cheap substitute for bone meal as a source of calcium in swine rations, and some success has been reported from its use in this way by the Purdue Agricultural Experiment Station. In the manufacture of superphosphate, 25 per cent or possibly more of the fluorin of raw phosphate rock is removed by volatilization, the amount probably varying with the grade of raw rock used and with the method of treatment According to Jacob and Reynolds,[12] a representative sample of superphosphate, containing 17 to 18 per cent of phosphoric acid, still contained 1.86 per cent of fluorin. The objections to the use of raw rock phosphate as a mineral supplement apply to the acidified product also, if only to a lesser degree. The same may be said of the so-called phosphatic limestones, representing naturally-occurring mixtures of phosphate-fluorid and carbonate of calcium.

The question of an iodin shortage in swine feeds is a geographic problem. The relation of iodin to thyroid function has been clearly established by many independent lines of research, and the effect of a shortage of iodin in the food on the gland and its functions has been established. That simple goiter in the human species is due to iodin underfeeding has been proven by the work of von Fellenberg, in Switzerland, and of Marine and McClendon, in this country. McClendon in particular[13] has called attention to the geographic distribution of simple goiter in this country and its relation to the distribution of iodin in food and water. Regions in which goiter is endemic proved to be regions in which water and home-grown foods are relatively low in iodin. The final evidence on the relation of iodin to simple goiter in human nutrition has been obtained in clear demonstrations that the periodic feeding of inorganic iodids to children is an effective

prophylactic against goiter and exerts a curative effect on existing goiter.[15]

The goiter situation with respect to farm animals has not been worked out so completely as this. The geographic distribution of simple goiter has not been so clearly established, but it is reasonable to assume that the distribution of human goiter and of animal goiter is much the same. Among live stock the effect of iodin deficiency has been noted particularly in the new-born and the very young animal. The hairless pig malady has been definitely traced to iodin deficiency by Smith[16] and Welch,[17] in Montana, and by Hart and Steenbock,[18] in Wisconsin. A general survey of goiter in domestic animals has been published by Kalkus,[19] of Washington.

The preventive value of iodid feeding to the pregnant sow has been clearly shown, so that in regions in which goiter occurs, even if only occasionally, the feeding of inorganic iodids to pregnant sows in the form of iodized salt,[20] or in mineral mixtures is advisable. However, the need of caution in the feeding of iodids to farm stock should be emphasized, since even small doses have been shown to be toxic.[21] The distribution of iodin in farm feeds is too little understood[22] to permit an intelligent balancing of swine rations with respect to this element. Its occurrence in sea water and in marine plants and animals is known to be relatively high, and the possibility of using dried sea weed or kelp as an organic source of iodin in swine feeding has been suggested and is being studied at the present time.

The need of iodin by young growing pigs, showing no evidence of goiter, has not been clearly demonstrated, although indications to that effect have been published by Evvard and Culbertson,[24] of the Iowa Experiment Station, and by Kelly,[25] of the Rowett Research Institute of Aberdeen, Scotland. Later work at the Rowett Institute was inconclusive[26] and the Institute is not prepared to formulate definite recommendations on the feeding of iodids to farm animals. Whether these variable results are due to a variable content of iodin in the basal rations used, or to the experimental error inherent in all group-feeding trials, cannot be told at present.

During the past year, the Swine and Nutrition Divisions of the Illinois Agricultural Experiment Station have been investigating the value of iodin as a supplement to the ration of young growing swine. The ration used contained corn, soy bean oil meal, linseed oil meal, alfalfa meal, and calcium carbonate. This ration was

fed to 26 Poland China pigs divided into 13 pairs. The two pigs in each pair were approximately equal in initial weight and were of the same sex. One pig of each pair received the basal ration only; the other pig received in addition one grain of iodin (as potassium iodid) daily. The intake of feed was kept the same for both pigs of each pair, the pig consuming the least determining the feed allowed its pair mate, so that at all times the only difference in the imposed experimental conditions was the consumption of iodin.

The initial weights of the pigs ranged from 57 to 76 pounds. At the present time, 7 of the 13 pairs have been removed from the experiment at final weights of approximately 175 pounds. In these 7 pairs, the iodin pig made the more rapid gain in 3 pairs, and the control pig in 4 pairs. Of the 6 pairs still on feed after 21 weeks, the iodin pig has made the greater gain in only 2 pairs, and the control pig in 4 pairs. The differences in weight between paired pigs were always small and were evidently insignificant, indicating that the dosage of iodin given did not increase the growth-promoting value of the basal ration used. An analysis of this ration for iodin will be made.

The value of iron as a mineral supplement to swine rations is receiving a great deal of attention. Perhaps the first impetus to this line of investigation was provided by some observations and experiments reported from the Rowett Institute in Scotland, by McGowan and Crichton,[27] in 1923 and 1924. The studies relate to a condition in suckling pigs that may be induced rapidly by feeding the dam a ration presumably low in iron during the last few weeks of pregnancy and during the lactation period. In the Scottish experiments the condition was prevented by the feeding of massive doses of ferric oxid (40 grams daily) to the sow. It was believed, however, that the young were benefited by themselves having access to the iron oxid rather than by receiving more iron through the milk. The trouble produced was characterized, among other ways, by a severe anemic condition, and has been explained as an iron-deficiency disease.

In 1924 and in succeeding years, Doyle, Mathews and Whiting,[28] of the Purdue Agricultural Experiment Station, undertook an extensive investigation of the occurrence and etiology of anemia in young pigs. They were able to reproduce the pathological symptoms in young pigs described by McGowan and Crichton, but the type of ration used seemed immaterial. The condition could be obtained readily on rations containing 10 to 18

per cent of tankage, a feed very rich in iron, or on rations containing an added iron salt, ferrous lactate. While they have not attempted to define the etiology of the anemia produced, it appears to be related to those environmental factors distinguishing indoor confinement from outdoor confinement.

During the summer of 1928, Dr. Carroll, of the Illinois Station, attempted without success to produce anemia in suckling pigs. Four Chester White gilts were confined indoors, away from all direct sunlight, from two weeks before farrowing until their pigs were seven to eight weeks old. They were fed a ration of corn and a mixture of equal parts of ground oats and wheat middlings, supplemented with semi-solid buttermilk. The 42 live pigs farrowed at no time developed pathological symptoms. Blood examinations of two pigs in each litter, and postmortem study of four pigs that were accidentally killed showed nothing suggestive of anemia. It appears fair to conclude that the cause and prevention of anemia in suckling pigs need further study.

A number of feeding trials on pigs have been reported in which the attempt has been made to determine the effect on the rate and economy of gains of small additions of iron salts to the rations. Most of these trials have been made at the Ohio Agricultural Experiment Station, and the results have been conflicting and difficult of interpretation, not only because the greater gains were at times secured with lots of pigs receiving no iron supplement, but also because the presence of iron-rich or iron-poor feeds in the basal ration seems unrelated to the indicated results of the iron salts added.

Using a controlled method of paired feeding of young growing swine, already referred to and briefly described, the Swine and Nutrition Divisions of the Illinois Station have investigated the value of additions of ferrous sulfate (copperas) to basal rations both high and low in iron.[29] The addition of one gram of copperas daily to the ration of one pig in each of the twelve pairs used did not improve the rate of gain. In fact, with the high-iron rations containing tankage, indications of a retarding effect on growth were obtained.

In a second year's work just completed, another iron salt, ferric citrate, was tested in the same type of feeding experiment. The basal ration used consisted of corn and a supplemental mixture containing soy bean oil meal, linseed oil meal, and alfalfa meal in the proportion of 3 to 2 to 1. Ten pairs of Duroc Jersey pigs were fed this ration in individual feeding-crates until one of

the pigs in each pair attained a weight of 175 pounds. The pigs weighed initially from 64 to 90 pounds. One pig in each pair received daily the same amount of basal ration as its mate and in addition three grams of hydrated ferric citrate. In nine of the ten pairs, the control pig, receiving no iron supplement, made the more rapid gain, although in only one pair was the difference in average daily gain more than 0.1 pound. The experiment is properly interpreted as a negative one, as far as the effect of the added iron salt on the rate of gain is concerned.

Blood examinations were made on seven of the ten pairs of pigs just after their removal from the experiment. For each of the seven pairs, the iron pig was found to have blood containing a greater concentration of red blood corpuscles and a greater concentration of iron. These results are summarized in table I.

TABLE I—*Erythrocyte counts and iron determinations*

PAIR	2	3	4	7	8	9	10	AVER.
	Erythrocytes (millions per cu. mm.)							
Control pig	6.40	9.14	6.01	7.47	6.43	6.87	8.12	7.21
Iron pig	7.64	9.25	8.29	8.04	7.49	7.23	8.58	8.07
	Iron (%)							
Control pig	.0455	.0504	.0436	.0406	.0450	.0400	.0414	.0438
Iron pig	.0478	.0556	.0480	.0424	.0455	.0484	.0479	.0479

On an average, the blood of the iron pigs contained 11.9 per cent more red cells and 9.4 per cent more iron per unit volume than the blood of the control pigs. However, the latter were not by any means anemic, with an average of 7,210,000 cells per cu. mm., and the slightly higher cell content and iron content apparently induced by the iron feeding, although of some scientific interest, should be accorded no considerable practical importance. In this connection it may be recalled that Whipple[30] has maintained dogs in an anemic condition at one-third the normal hemoglobin level for four years in perfect health and activity.

It may later develop that certain combinations of feeds will prove to be deficient in iron for normal growth and functioning, but at present it does not appear that iron deficiency is at all prevalent among swine rations. A systematic study of the iron content of farm feeds and of the iron requirements of swine in different stages of growth and activity is needed before a satis-

factory solution of this question will be possible. It is worthy of note that the mere grinding of feed contributes to it a considerable amount of metallic iron[31] that may become available to the animal by solution in the acid gastric juice.

With the consideration of the sodium, calcium, iodin, and iron deficiencies of swine rations, the field of profitable discussion has been covered. The only excuse for continuing the subject of mineral deficiencies is afforded by the widespread use of other minerals in home-made or commercial mixtures for which there is no tangible justification. Saline laxatives frequently are found in such mixtures, and at times to such an extent that their value in furnishing those elements that are definitely required is seriously impaired. Corn contains from 1.8 to 2.0 per cent of crude fiber, and other grains and by-product feeds contain up to 10 per cent or more.

From the results of feeding laboratory animals on purified and and concentrated rations, it would appear that 2 per cent of indigestible ballast in the ration is adequate for the proper regulation of bowel movements. The need for saline cathartics is not evident in general feeding practice, and in an actual experiment reported from the Philippine Islands, no advantage accrued from their inclusion in swine rations.[32] At the Ohio Station, also, the results obtained with Glauber's salts have not been sufficiently clear-cut to warrant definite conclusions.[33] As regards Epsom salt (magnesium sulfate), Palmer, Eckles and Schutte[5] have reported marked interference with calcium retention by this compound in dairy cows.

The value to be expected from the use of charcoal and sulfur in the ration of *normal* swine is problematical. Sulfur may be distinctly toxic, if consumed above minimal amounts, due to the hydrogen sulfid into which it may be converted by the intestinal bacteria,[34,35] and in concentrations below those producing definite toxic symptoms, distinct retardation of growth has been observed in rats.

It seems that each discovery of the need of a new mineral element by animals is sufficient excuse to include it in a mineral mixture for live stock, although its value there depends solely upon whether farm feeds are deficient in the element or not. It has but lately been shown that animals need manganese, that copper has a function in hemoglobin formation, and that aluminum, boron, zinc, fluorin, nickel, cobalt and other elements are sufficiently widespread in animal tissues as to suggest definite

functions there. But until it is shown that farm feeds are deficient in such materials, obviously it is premature to include them in swine rations. Conservatism in such matters will prove to be the saner and ultimately the more profitable policy to pursue. The argument that inorganic compounds possessing definite value in nutrition should be added to rations not known to be deficient in them as a sort of insurance against malnutrition seems a spacious one when the animals remain in good health and eat and gain in an apparently normal fashion. When trouble appears and symptoms of ill-health and malnutrition are evident, it is time to enquire of the cause and to apply the specific remedy needed. It is a vain hope to expect supernormal nutrition from ill-considered additions of mineral compounds to swine rations.

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. . . The meeting adjourned at 12:00 noon. . . .

ADJOURNMENT.

FRIDAY AFTERNOON, DECEMBER 7, 1928

The sixth session convened at 1:30 p. m., President Cary presiding.

President Cary: The first paper this afternoon will be on "Nutritional, Diseases of Swine," by Dr. G. Bohstedt, Professor of Animal Husbandry, University of Wisconsin, Madison, Wisconsin.

. . . Dr. Bohstedt read his paper. . . .

NUTRITIONAL DISEASES OF SWINE

By G. Bohstedt, *Madison, Wis.*

University of Wisconsin

No one dealing with live stock in one capacity or another can ignore feed as a factor in the health of animals. To be sure, human nature is such that whether we are chemists or pathologists, we are apt to interpret certain phenomena in the light that we have, or as our training has equipped us. Thus in the case of an animal in distress we are apt to look for either a dietary deficiency or an organism, as the causal factor. This is a perfectly natural thing to do but one should never close one's mind to possibilities other than those that at the time seem so very plausible.

Years ago the conception of nutritional abortion in cattle did not appeal to some of us. Wasn't there a bug involved, after all? In order to help clear the atmosphere, Professors E. B. Hart and F. B. Hadley, of the Wisconsin Experiment Station, recently made a special effort in running a carefully controlled experiment with two dairy heifers. These heifers were fed one of the rations that had been fed in experiments before and balanced from a restricted source, thus: wheat straw, wheat meal, wheat gluten, and common salt. Repeated blood tests were made to check the presence of infection with the contagious abortion organism, but

the results were uniformly negative. Both heifers dropped calves before full term and had retained placentas that had to be removed by a veterinarian. Blood tests after calving again showed the cows to be free from the abortion organism. Together with other experiments on a more extensive scale, as far as numbers were concerned, it was proved that there was such a thing as nutritional abortion which was, therefore, wholly separate from contagious abortion.

Nutritional deficiencies may, therefore, be widely prevalent and co-exist with infectious diseases, so that frequently some doubt exists as to whether it is one or the other. It is wise to be open-minded in this respect. Also, frequently, a nutritional deficiency so weakens certain organs or tissues as to pave the way for an infection, as will be brought out later on. This situation is somewhat comparable to infectious disease complications where the resistance of the body has been lowered by the ravages of one organism opening the door or breaking down the barriers for another organism that has lain in wait all this time.

Hogs in our northern climate are especially susceptible to deficiency diseases for the reason that they are out of their natural environment. A hog feels much more at home in a semi-tropical country, where, in or near the woods and marshes, he may enjoy the shade and the soft, moist ground. In this ground he may root to his heart's content, finding roots or tubers, grubs, and, incidentally, considerable minerals as well as vitamins; or he may chew the leafy vegetation, especially the tender sprouts and shoots that are chock full of wholesome and efficient proteins, all sorts of ash constituents, and the indispensable vitamins. Acorns or beechnuts may be around in abundance. Also there is always the opportunity for small game.

Altogether this hog, therefore, may enjoy a splendid diet which is very satisfactory in everything, perhaps, but starch or fattening properties. But this wild hog does not care for excess adipose tissue. He does not have to fight a cold climate through this protective fatty tissue. He cares more for speed, and speed serves him much better than weight. There are some jokesmiths even now who would have one believe that in certain sections of the country speed in hogs is valued beyond any other attribute so that no hog is any good unless he can get away from a darky, or in some cases even a hound.

A modern hog is situated so differently. Man has imposed restrictions upon him that very often result in disaster. For one

thing, continued selection and mating the best with the best has resulted in a type of hog that has a tremendous growth impulse within it. In proportion to this ambition to grow, there are nutritional needs that, if they are not satisfied, will involve the animal in all sorts of complications: unthriftiness, lameness, stiffness, and partial or posterior paralysis. It is usually the most rapidly growing pig in a group that is first affected, for this is the one that first incurs a shortage. It is seldom the runt that develops rickets or other deficiency diseases. Nutrition experts recognize the starvation factor or slow growth as a protection against effects of certain dietary deficiencies.

And then we feed this hog grain. Corn and hogs are supposed to go together. Well, they do go together up to a certain point, and then they part company, for Mr. Hog dies. Such is the picture if corn, or, for that matter, any grain, alone, is fed to a growing pig. Grains or grain products such as bran, middlings, oilmeal, and the like, are sadly deficient in a number of respects. The proteins are more or less deficient, but this is not the worst offense. The lack of minerals is a much more serious one, perhaps the worst one, and vitamins also are lacking. Grains or grain by-products are, therefore, an inefficient diet.

Animal proteins such as tankage, fishmeal, or skimmilk fortify the grains wonderfully well but leafy materials, green or dry, are perhaps even more important. Young tender sprouts of the different grasses and legumes are, of course, the best of all, but a right good substitute for such tender grasses which pigs could get in pastures and forage crops, can be had by feeding a good grade of pea green, leafy alfalfa hay or other legume hay. Such hay in the winter is a good substitute for pasture, as has been demonstrated time and again in experiment and in practice.

A few years ago, at the Ohio Experiment Station, during the winter time, a very satisfactory fattening ration was fed that had in it no animal by-products at all. However, this ration was compounded in the light of our latest information on nutrition. Every ingredient of the mixture served a definite purpose. The mixture consisted of yellow corn, soybean oilmeal, linseed meal, alfalfa meal, and the three minerals, acid phosphate, limestone and salt. Ten pigs were fed this ration, carrying them from 48 pounds to a market weight of 225 pounds. They gained 1.22 pounds daily per pig and required 392 pounds of the feed mixture for every 100 pounds increase in live weight. This is an excellent showing, indeed.

The pigs gained even better than a corresponding lot of pigs fed yellow corn, tankage, limestone and salt, that gained only 1.16 pounds per day and showed a slightly higher feed requirement. Even the mixture of yellow corn, tankage, linseed meal, alfalfa meal, and salt caused still another lot to gain only 1.2 pounds daily per pig. The highest gains of the entire experiment were secured only when skimmilk was added to yellow corn, tankage, limestone and salt, when the pigs gained 1.33 pounds. This last ration is, of course, recognized as a superior ration but using two animal feeds, whereas the first ration mentioned used nothing but vegetable and mineral matter. Again it must be stressed, however, that it included leafy alfalfa meal which is very rich in several vitamins and it included an abundance of calcium, phosphorus, and other essential minerals.

Hogs, of all farm animals, are the most susceptible to the effects of poor rations. Some years ago, in Ohio, data were collected from live stock shipping associations of eight counties where, among other interesting findings, the following facts were discovered. For every 100 pounds of beef on the hoof shipped from these stations to the market there was incurred a loss through accident of one sort or another of one-seventh cent; for every 100 pounds of calves shipped there was a loss of 1.1 cents; sheep, 2.5 cents; and hogs, 3.3 cents. These figures show that more losses take place in hogs from lame or crippled or dead hogs than take place with other classes of live stock. One may say that this is natural, of course, for the reason that hogs are close to the ground or the floor and when fat, as they are bound to be on being shipped to market, they are apt to overheat. They are also more awkward on being loaded and unloaded and are, therefore, more subject to becoming crippled. This is easily appreciated, of course.

At the same time one may refer to an experience at the Ohio Experiment Station, in June of 1925, when two carloads of experiment animals were placed on board cars at Wooster to be shipped for demonstrations at different points in the state of Ohio. These hogs involved groups of pigs fed experimentally in one way or another, mostly minerals, but a few lots without minerals in addition to grain rations. In the case of the latter pigs a number of them did not even reach the local depot for shipment. They succumbed to the effects of the hot weather and the driving and loading during the extremely hot weather that prevailed. None of the mineral-fed pigs were lost in this respect although they were just as fat as, or, in fact, considerably more so than those that

had not been getting any minerals. This is one instance indicating that a good fattening ration, complete in the several respects, results in a stronger pig than can take care of itself and stand so much more grief in shipping or driving than it could if fed rations deficient in minerals and vitamins.

Mineral deficiencies are probably the more prevalent of the various kinds of deficiencies. Common table salt we know is urgently needed by all farm animals. Because this fact is realized by all live stock men, we do not ordinarily think of a salt-deficiency disease. If other minerals were appreciated in the same way that salt is, perhaps as little trouble would be incurred from that source. However, such is not the case and perhaps there is a good reason for it. It is because most of the other minerals are usually present in feeds in such amounts as to permit good health and thrift of the animal. Now and then, however, certain minerals that may ordinarily be present in feed and that are needed in only very small amounts by the animals may be lacking and then we may expect trouble just as certainly as if minerals that are needed in large amounts were absent. One such instance is trouble resulting from iodin deficiency in the feed.

The Effect of Iodin Deficiency

The animal body requires a certain amount of iodin for proper functioning, which iodin is doled out into the blood-stream by the thyroid gland in the neck. The iodin compound elaborated by this gland is thyroxin, containing about 60 per cent iodin. Iodin is necessary in various body activities. It is especially necessary for a pregnant animal and functions in the metabolism of the growing young, the nourishment of the skin and hair, the growth needs in other respects as the assimilation of minerals and nitrogen, and the resistance to bacterial infections.

Iodin needs to be present in only very minute amounts and emphasizes the importance of the infinitesimal, as does copper in the iron assimilation, or vitamin D in calcium and phosphorus assimilation of the body. Both iodin and copper need to be present for body metabolism but in excess both of them are poisonous. Goiter in humans is due to a shortage of iodin in the system in response to which the thyroid gland enlarges or extends itself in its activity to supply the needed thyroxin. It is held that under such a condition it is a mistake to administer liberal doses of iodin, for the reason that this whips the gland into excessive activity in the elaboration of the iodin compound,

thus producing a correspondingly excessive metabolism of the body.

It is supposed that rather than feed iodin to such a patient, it is better to administer thyroxin in appropriate doses so as to rest the gland rather than to stimulate this gland into undesirable activity. At any rate, the treatment of goiter or abnormal thyroid activity is not a simple thing. The dosage of some of these substances needed in only small amounts by the body is a very important problem. However, in the case of swine we are not so much concerned with the treatment of goitrous individuals as in the prevention of this malady in the young. It, therefore, becomes a simpler matter.

It has been found that hairless pigs can be prevented by feeding the pregnant sow minute quantities of iodin or potassium iodid. It required only from ½ to 2 grains and in some cases much less, of potassium or sodium iodid daily per sow during the gestation period to prevent hairless pigs. An easy way of administering iodin is by way of iodized salt, which contains about .02 per cent of iodin. Iodized salt is now available in that it is manufactured by several large salt companies.

Potassium iodid may also be added to mineral mixtures, as where ⅓ ounce of potassium iodid is added to every 100 pounds of a mineral mixture, such as one that has given quite general satisfaction consisting of 40 pounds finely ground, high-calcium limestone, 40 pounds steamed bonemeal, and 20 pounds salt.

Aside from the difficulty of hairless pigs which has come to be quite generally understood, I wish to point out that the use of iodin for growing and fattening pigs has in a number of experiments proved very successful. Thus at the Iowa Experiment Station, Dr. John M. Evvard and co-workers a number of years ago fed pigs iodin in comparison with check lots that received the same ration but with the absence of additional iodin. All pigs were carried from a weight of about 50 pounds to market weight. The average daily gain and feed requirement for every 100 pounds increase in live weight during three experiments are shown in table I.

The difference in gains was not large and would ordinarily be considered as within the limits of experimental error. Furthermore, in only one of the two cases was there a saving in feed. Somewhat similar results have been secured at other experiment stations where the data from iodin feeding conflicted. Iodin in some cases showed an improvement, in other cases not. There

is a difference, one state with another, as to the need for additional iodin in the ration of pigs or other live stock. In general, the southern states seem to be fairly well supplied with iodin in the soil and the crops. A number of the Great Lakes States, however, are in the iodin-deficient belt, as are also a number of the states in the far Northwest.

Kelly, at the Rowett Research Institute of Aberdeen, Scotland, as a result of four experiments with pigs where iodin was added to a grain ration, secured a considerably greater absorption of calcium, phosphorus and nitrogen in iodin-fed pigs.

A considerable amount of data of this sort makes one wonder whether iodin might not well be fed more generally than has been the case, instead of feeding iodin for a more or less specific purpose, therefore, as in the prevention of hairless pigs. This mineral in large sections of the northern United States seems called for in swine rations and perhaps other live stock rations for growing, fattening, and other productive purposes. It seems that the more general use of iodized salt may be recommended.

TABLE I.—*Results of Iowa experiment*

	Without Iodin		With Iodin	
	Ave. Daily Gain (Lbs.)	Feed per 100 Lbs. Gain (Lbs.)	Ave. Daily Gain (Lbs.)	Feed per 100 Lbs. Gain (Lbs.)
1. Rape pasture....	1.23	440	1.33	385
2. Dry-lot..........	1.52	425	1.65	385
3. Dry-lot..........	1.37	485	1.55	446

It is seen that the pigs receiving iodin made uniformly faster gains and required less feed per unit of gain. In two experiments at the Ohio Experiment Station a few years ago a similar comparison was made as follows:

TABLE II.—*Results of Ohio experiment*

	Without Iodin		With Iodin	
	Ave. Daily Gain (Lbs.)	Feed per 100 Lbs. Gain (Lbs.)	Ave. Daily Gain (Lbs.)	Feed per 100 Lbs. Gain (Lbs.)
1. Dry-lot..........	.97	476	1.01	444
2. Dry-lot..........	.97	445	1.03	471

The Effect of a Deficiency of Calcium, Phosphorus, or Vitamin D. Rickets and Allied Bone Diseases

Rickets is a disease of the young, whereas the corresponding disease, osteoporosis, affects adults. In the case of rickets the young animal never had a well-developed skeleton, whereas in the case of osteoporosis there has been a removal of calcium and phosphorus from the bones, leaving these in a porous and brittle condition and, therefore, easily subject to fractures. For the prevention of such bone diseases and particularly rickets, all three factors, calcium, phosphorus, and vitamin D, which is contained in such abundance in cod-liver oil, need to cooperate. The ultraviolet light of sunlight, or such as emanates from the carbon-arc light or mercury-vapor light, is the equivalent of vitamin D in enabling the body to deposit the minerals in the bones.

If calcium is present in large amounts and phosphorus is below optimum in amounts, one kind of rickets may occur which is referred to as high-calcium rickets. A similar thing occurs where the ration may be poor in calcium but high in phosphorus. Where a considerable amount of cod-liver oil is fed, or vitamin D, it seems that the efficiency of the body in the assimilation of minerals of the bones is raised to such a degree that rickets may be prevented. Where, however, there is only a small amount of vitamin D in the ration, the minerals, calcium and phosphorus, need to be present in optimum amounts so as to become incorporated in the processes of bone growth. Thus it is seen that minerals and vitamins go hand in hand for the formation of bone.

Grain rations fed to pigs in dry-lot make for poor bone for the reason that calcium is lacking and vitamin D also is lacking even though there may be a sufficiency of phosphorus in the ration.

If animal products, particularly fishmeal or tankage, are fed with a grain ration the mineral situation is much improved. Skimmilk makes for great improvement. Nevertheless, vitamin D would still need to be amplified for best results, such as is done through the addition of cod-liver oil, or, on a more practical basis, legume hay.

The clinical symptoms of rickets in growing pigs are unthriftiness, therefore, a harsh, starey coat of hair, sometimes a wrinkly, scurvy skin. In more advanced stages, stiffness, lameness and posterior paralysis occur. The bones of pigs fed a grain ration, especially when fed in dry-lot, are soft and are rather easily

FIG. 1—A Cause of Lameness in Pigs Fed Deficient Rations

Longitudinal sections of normal and abnormal femurs of pigs showing (on the left) a normal femur as is produced on rations adequate in minerals and vitamins, resulting in a dense, well-calcified and ossified bone.

The abnormal femur (on the right) was taken from a pig fed a ration containing 4 per cent blood meal. The marrow cavity extends within nearly one-fourth inch of the zone of provisional calcification. The cellular disorganization above this line suggests rickets. However, there is lacking the metaphysis which is typical of rickets. The shaft of the femur is thick but weak as is indicated by the spontaneous fracture near its middle.

(From Ohio Agricultural Experiment Station.)

deformed or fractured. In our experimental work in Ohio we have observed numerous fractured bones. Thus femurs would show conditions of spontaneous fracture, due to muscular contraction of the thigh muscles. Such pigs would of course, be lame and lose weight. A number of pigs on autopsy showed a row of knobs across the ribs referred to as "beady" ribs, an evidence of rickets. Histological examinations would reveal that there was an extreme disorganization at the growing points of bones making for a very weak structure.

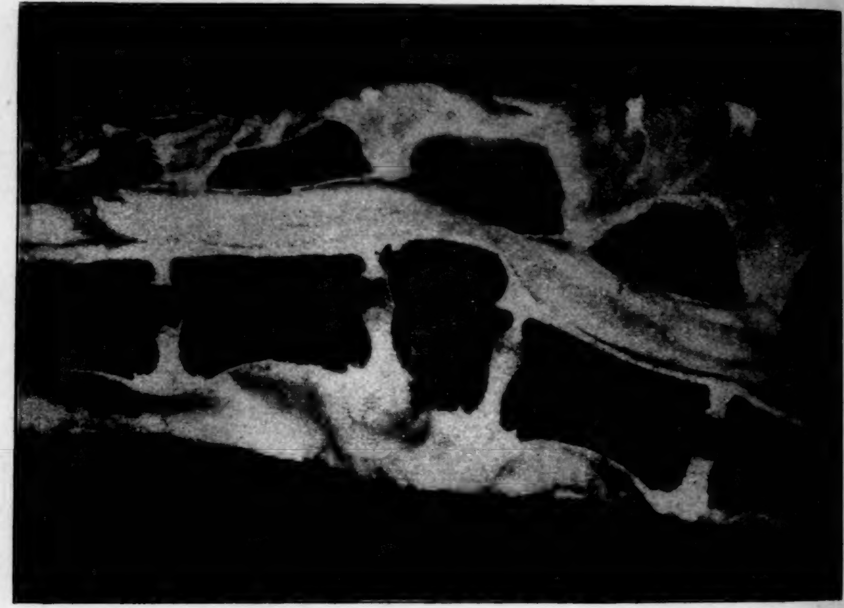

Fig. 2—Fractured Vertebrae a Cause of Posterior Paralysis

Too little mineral matter in the ration accounted for weak vertebrae that would fracture easily and squeeze on the spinal cord. The pig from which the above tissue was taken had been fed white corn, wheat middlings, linseed meal, and salt.

(From Ohio Agricultural Experiment Station.)

It was found that posterior paralysis was caused by such poorly constructed spinal vertebrae in that they would easily fracture under stress and squeeze upon the spinal cord, thus amounting to a nerve-block for the rear legs. Uniformly where pigs were in this paralyzed condition, our autopsies showed that somewhere in the lumbar or sacral region of the spinal column a vertebra had become fractured.

The feeding of about 1½ per cent ground limestone in a grain ration consisting of corn, wheat middlings, linseed meal, and salt

produced hard, strong bone. Tankage and fishmeal added to a grain ration made for good bone.

Merely rooting in the soil where the pigs had a bare lot to run on, but fed a grain mixture, prevented clinical evidences of rickets, until freezing weather in the fall prevented pigs from rooting in the soil. It is thus seen that merely chewing dirt constitutes a preventive of a sort.

The greatest safety factor, however, was pasture, especially when minerals were added to the grain ration. Such a system of feeding came closer to nature and approximated the original food supply of the ancestor of all our hogs, the wild hog in his native state.

Pigs on pasture are rarely subject to nutritional deficiency diseases, which should be a lesson to us in the winter feeding of pigs; therefore, providing them with an effective pasture substitute, such as rations will have if they include, for small pigs, say about 5 per cent ground alfalfa meal and preferably in addition to this, skim milk or such another good animal protein feed as tankage or fishmeal. Sows during the winter time may well be fed as much as 10 per cent ground or chopped alfalfa hay or allowed access to long hay in the suitable slatted rack.

An inquiry into the ration of pigs in the winter time will frequently explain the reason for an ailment of one kind or another.

The Effect of a Deficiency of Vitamin A

Vitamin A was the first vitamin discovered and was found to be necessary for the growth of animals. It is present in great abundance in cod-liver oil, as is vitamin D. It is present also in butter and, for that matter, milk. Alfalfa hay, clover hay, and other legume hays are quite rich in vitamin A. In a number of experiments at the Ohio Experiment Station, where we studied rickets in pigs, we ran into difficulties that seemed to point to vitamin-A deficiencies.

However, Dr. J. S. Hughes and co-workers, of the Kansas Experiment Station, established more clearly the effect of a shortage of vitamin A in the rations of pigs where these were fed white corn, tankage, and bone ash for many months. Differing from rickets, which may come on in relatively few months when pigs are fed a ration deficient in minerals and vitamin D, these ailments from a lack of vitamin A appeared more slowly or only after the animals had been fed several months longer, in some cases

only after a year on the ration of white corn, tankage, and bone ash.

The pigs or young sows that they fed would have staggers or an incoordinated gait. In extreme cases they would exhibit spasms. Either the rear legs or fore legs would give way on them although in the case of rear legs, it was not a case of so-called posterior paralysis. A few of the sows developed blindness.

All these symptoms were avoided by feeding yellow corn, or bright green leafy alfalfa hay, 5 per cent, or a small amount of cod-liver oil, or butter.

But where the ration of white corn (lacking vitamin A) and tankage (also lacking vitamin A) with bone ash, was fed, there seemed to be a degeneration of nerves throughout the body. This was proved by numerous sections made of the spinal cord, the sciatic nerve, the brachial plexus, and optic nerves.

Such vitamin-A deficiency, which at times affects the tear-glands in drying them up, permits the development of an infection affecting the conjunctiva of the eye and producing ophthalmia. Here is an instance of where a nutritional deficiency and an infectious disease participate.

Similar infection is permitted where pigs, white rats, or chicks suffer from infections of the respiratory tract, frequently developing into pneumonia, where the rations are too low in vitamin A.

Other Deficiency Diseases

There are other deficiency diseases in pigs that are bidding for recognition, such as nutritional anemia in small pigs, due to the lack of iron or the inability of the animal to absorb iron from the ration. Milk, of course, whether from the sow or other animals, is low in iron. It has been found at the Wisconsin Station that very minute quantities of copper are needed for the assimilation of iron and the use of iron in the manufacture of hemoglobin of the blood. Thumps appear to be a disease due to an iron deficiency. However, the prevention and treatment of such diseases are still largely in the experimental stage, so that no recommendations can be made as to dosage. For that matter, nearly all of our rations, as far as known, contain some iron and copper, this in the main obviating the necessity of making additions of iron and copper salts. The field of deficiency diseases, however, is engaging the attention of a great many investigators and the next decade should reveal many truths, or facts that are now hidden from our view.

President Cary: The next paper will be on "Iron in Nutrition," by Dr. E. B. Hart, Professor of Agricultural Chemistry, University of Wisconsin, Madison, Wisconsin.

. . . Dr. Hart read his paper. . . .

IRON IN NUTRITION

By E. B. Hart, *Madison, Wis.*

Professor of Agricultural Chemistry, University of Wisconsin

Ever since it has been known that the chief respiratory pigment of the blood, hemoglobin, contains iron, the relation of iron to nutrition has been extensively studied. This has applied particularly to the users of iron in those diseases of the blood, which are characterized by a low hemoglobin content or a low erythrocyte count. The administration of iron salts to anemic animals or anemic people has been a practice in medicine for over a hundred years and, in that peculiar disease of young girls known as chlorosis, the administration of iron, through the introduction of the Blaud pill, has become a specific and effective treatment.

Scientists and physicians have fought over the ground as to what kinds of iron to use in the treatment of anemia, some believing that inorganic iron was not absorbed, while only organic was effectively used. Most of these older conclusions are based upon the fallacy that after the administration of iron salts, its failure to appear in the urine indicates that it has not been absorbed. This idea is erroneous, because we now know that many of the heavy metals, including iron, after injection into the blood-stream, are eliminated through the intestine. Consequently, it is not a fact that the non-appearance of iron in the urine after its administration is an indication that it has not been absorbed.

Bunge was responsible for the idea that organic iron is superior to inorganic iron, because in some of his experiments he found that anemia was cured when he used iron preparations made from the yolk of the egg, while inorganic iron salts were not effective. In the light of modern research, the reason for this now becomes clear, namely: that his preparations from the egg-yolk were contaminated with other inorganic materials that aid in hemoglobin building. Recently the question of iron medication has centered around whether the iron salts were soluble or insoluble and while there is some merit in that point of view, yet it is now definitely known that that phase of the problem is not of such great importance.

It has been known for a half-century that whole milk as a sole article of diet will not support a normal blood-stream; that animals on a whole-milk diet will sooner or later become anemic, with a distinct decrease in the hemoglobin content of the blood and the erythrocyte count. General assumption has been, in explanation of this phenomenon, that milk is particularly low in iron, and the administration of iron salts in the anemias of the suckling stage has been prescribed as a remedy.

In our first experimental work, in the study of this problem, we used rabbits. They are easy to bleed, and a distinct dietary anemia is produced in them in the course of four to six weeks by the use of a whole-milk diet. Cows' milk was always used. On this diet the anemia could not be corrected by the administration of ferric oxid. On the other hand, when ferric oxid was supplemented with a certain amount of green cabbage or a certain amount of lettuce, the anemia was beautifully corrected. Of course, the conclusion from such an experiment might be made that we were administering with the ferric oxid some more available form of iron. To obviate this criticism, the dried lettuce or dried cabbage was extracted with alcohol and practically iron-free extracts prepared in this way. These extracts, when used to supplement the ferric oxid, also alleviated the dietary anemia in rabbits. One might conclude that the alcoholic extract was taking out some vitamin which was an effective supplement. To avoid any such supposition, we finally burned the lettuce in an electric furnace, so as to destroy all the organic substances there, and found that by the use of this ash material as a supplement to ferric oxid the anemia was beautifully corrected in the case of rabbits. This paved the way to a very definite conclusion, that the anemia induced by milk was an inorganic deficiency which not only included iron but apparently some other inorganic substance or substances.

Because of gastro-intestinal troubles, to which rabbits are so subject, and the difficulties of getting long continuous records with them, we turned to the rat as an experiment animal. Previously, we had thought that the rat could not be used, because in other laboratories it had been found impossible to induce an anemia in the rat by a whole-milk diet until the second generation. We found, however, that the rats in our colony could be brought to an anemic condition very readily by a whole-milk diet, and that they could be bled beautifully by snipping off the tail. All hemoglobin determinations were made by the Newcomer

method, and we soon learned that rats at weaning time, placed upon whole milk, would gradually recede in their hemoglobin level from 5 to 4 to 3 to 2 grams of hemoglobin per 100 cc of blood, and then die. Postmortems always showed the dilated heart and internal edemas.

With the rat as the starting point, we next wanted to redemonstrate that pure iron salts, soluble or insoluble, did or did not correct this anemia. Consequently iron salts were prepared from pure iron wire and we used the sulfate, chlorid, acetate, citrate, and phosphate, all of which were fed at levels of 0.5 mg. of iron per day. These were absolutely ineffective in correcting this dietary anemia. While there could be no doubt that milk is low in iron—it contains about 2 or 3 mgs. per liter—yet it is perfectly clear that iron was not the only factor involved.

We next proceeded to repeat what had been done with the rabbits, namely, to correct this anemia by adding to the milk the *ash* of lettuce in an amount which supplied the half mg. of iron. This was beautifully effective and restored the hemoglobin from the low level of 3 grams per 100 cc of blood to 10 and 12 grams per 100 cc in the course of four weeks. We not only demonstrated that the ash of lettuce was distinctly effective, but also that the ash of liver and the ash of corn would bring about this restoration in the blood-stream. These data secured with the rat paralleled and reinforced the work that had been done with the rabbit and made it perfectly clear that there was some *inorganic* substance other than iron in these ashes that was deficient in the milk.

The fact that the ash of liver was very effective attracted our attention. At about this time Minot and Murphy, of Boston, had brought out their successful treatment for pernicious anemia, namely the liver diet, and while it was not expected that there was any relation between the type of anemia with which we were dealing and pernicious anemia, yet we were interested to know whether the liver or preparations from the liver would be effective in curing our type of anemia. At about this time a large pharmaceutical house in this country was beginning to make from liver an extract which was very effective in the treatment of *pernicious* anemia. We secured some of this material and fed it to our anemic rats as such, without any beneficial effect. We next supplemented it with iron and then found that it was very successful. It was next burned in the electric furnace and all the organic matter destroyed, and the ash fed to our anemic rats with the supplement of iron. This procedure was also very

effective in restoring the blood-stream. It was apparent that there was something common to the liver, liver extract, corn, lettuce and cabbage, that could supplement iron in hemoglobin building.

Since this work had indicated some new factors of inorganic character in the ash of biological materials as necessary for hemoglobin building, we proceeded to fractionate the ash and to find in what group or part of the ash this substance was lurking, by dissolving it in hydrochloric acid and then removing the silica. It was found that the silica fraction was ineffective, while the effective fraction was in the filtrate from the silica. We next took this filtrate and fractionated it by the use of ammonia and found that the precipitate as well as the filtrate was effective, showing that a sharp separation was not being made. The hydrochloric extract of the ash of liver was fractionated by the use of hydrogen sulfid, and it was found that the hydrogen sulfid precipitate was very effective while the filtrate was non-effective. All these clues indicated that we were dealing with some metal as a supplement to iron which would be found precipitable by hydrogen sulfid, but we were in ignorance as to what this metal was.

When the ash of these biological materials was being prepared, and especially that of liver, we often noticed a pale bluish color in the residue. Knowledge of the respiratory pigments of some invertebrates taught us that in the cases of some of the crustacea and some mollusks, the respiratory pigment was a copper protein compound known as hemocyanin. With the further knowledge that our unknown substance was precipitable by hydrogen sulfid, we thought particularly of copper. We had, at this time, one anemic rat whose hemoglobin was down to a 2-gram level, and we ventured the absurd experiment of adding 0.5 mg. of iron to his diet, supplemented with .25 mg. of copper as copper sulfate. To our great surprise, within two weeks the hemoglobin level rose from 2 to 8, from 8 to 10 in four weeks, and in six weeks was back to 12, the normal level. The animal picked up rapidly, the weight curve went up, and we seemed to have demonstrated that copper was the inorganic element which supplemented iron in hemoglobin building.

From this first experiment we proceeded to prove our point more definitely and to use larger numbers of anemic rats with variable dosages of copper, and in no case have we ever failed to correct the dietary anemia in rats by the addition of a highly

purified iron salt, supplemented with traces of copper. We have used as low as .001 of a mg. of copper per day, which gradually restored the blood-stream, but not quite so rapidly as where we used .05 or .01 mg. per day.

This work indicated that copper in traces is absolutely necessary as a supplement to iron in hemoglobin building. In does not appear that copper is part of the hemoglobin molecule, but rather that it acts as a catalytic agent to the iron in hemoglobin building. It would appear from this work that copper in traces becomes absolutely necessary for mammalian life, and that of all foodstuffs, milk is extremely low in copper. It is a fact that milk is very low in copper, one liter containing about 0.2 mg. We have analyzed milks from various parts of the country with the idea that possibly the feed supply in various regions would affect the copper content of the milk. Such does not appear to be the case. The copper content of the milk from Maine does not appear to be different from that of California. We have also tried to increase the copper content of milk by the feeding of extra amounts of copper to cows, but in this we have been wholly unsuccessful, it being impossible to raise the copper or iron content of milk by feeding the animal more of the salts of these metals. This is an important point, because in the treatment of anemias of infancy, no doubt many attempts will be made to do it by increasing the content of iron and copper in the food of the mother. This method will certainly prove ineffective.

We have, at the present time, analyzed not only milk for its copper content, but also a great array of foodstuffs, and are surprised to find how widely distributed copper is as a normal constituent of our foods. Every foodstuff that we have examined contains from 6 to 10 mgs. of copper per kilo of dry matter, while some foods run much higher than this, such as the blue-point oyster or the liver of animals. On the other hand, some foods run very much lower, as for example, the flours made from the cereal grains.

These findings that copper supplements iron in hemoglobin building have also led to an attempt to use such combinations in the cures of certain types of anemias. One would *not* expect such treatment to be successful in anemias induced by infectious agents. Apparently their greatest good is going to come in the treatment of anemias induced by deficient diets rather than in the treatment of anemias induced by infectious agencies. In adult life, it is hardly to be expected that there is a deficiency of

iron and copper in the diet, although there may be certain types of perverted metabolism calling for more of these agents, as in the case of chlorosis of puberty.

Already, very successful results have been secured in the treatment of anemias of infancy by the use of iron salts. This work has been done by Dr. Mackay, of Queen's Hospital, London, where there is a great deal of anemia among the children, accompanied by their lack of resistance to other diseases. Dr. Mackay has followed the wise practice of incorporating the iron salts directly into the milk and then making a milk powder, which was used in infant feeding. The iron salts that were used contained traces of copper, and their effectiveness, no doubt, is related to the fact that they did contain traces of copper. It is a notorious fact that most commerical iron salts contain traces of copper, and the experience of the pediatricians of our own hospital has been that those iron salts that are free from copper are clinically ineffective, while the best ones are those that contain small amounts of copper. The time will no doubt come when iron salts with specified amounts of copper will be prepared and distributed for their use in certain types of anemia.

Anemias in our live stock are not generally recognized, and iron medication is by no means extensively practiced. We do not hear of anemia in calves, or anemia in chicks, although we do hear of anemia of young pigs. Nature in a good many cases has provided against the possibility of anemia on the milk diet, or in the nursing stage. The young come into the world with a very considerable store of iron and copper in the liver, which will be drawn upon during the nursing stage. There is also another safeguard, apparently, in the very high hemoglobin content of the blood at birth. The human infant is born with a hemoglobin content of the blood at 20 to 23 grams per 100 cc of blood, while in normal adult life it is in the neighborhood of 14 to 15 grams. This is an extraordinary precaution against the anemia of infancy, but it does not indefinitely protect the infant. The calf comes into the world with a hemoglobin of about 10 to 12 grams, but does not appear to reduce that hemoglobin or go into an anemic condition during the suckling stage. The chick picks natural food early after being hatched, which provides it with iron and copper, and we find the hemoglobin content of the young chick as high as in adult life.

On the other hand, there is a generally recognized anemia of young pigs. This critical period is at from three to six weeks

of age. They are born with a hemoglobin content anywhere from 5 to 10 grams, and a rapid decline occurs in the first two weeks. Anemia of suckling pigs is a serious problem and great losses occur in this early stage of their life. It would appear that the anemia of young pigs is a dietary deficienty and its treatment should fall in line with a copper-iron medication. This anemia in young pigs was recognized four or five years ago by McGowan, in Scotland, and he successfully treated it by putting iron oxid in the ration of the sows and scattering this ration around so that the little pigs would have access to some of it during the nursing stage. I venture to say that the iron oxid contained traces of copper which made the combination successful.

Lately this problem has been extensively studied at Purdue University, by Doyle and Mathews, and they have particularly stressed the relation of the outdoors to the corrective factor for the anemia of young pigs. Up to the present time they have not completely analyzed the situation, and science waits with great interest what will be the final outcome and method of treatment of this very distinct farm problem, the anemia of pigs in the suckling age.

President Cary: Gentlemen, I want to say that this has been one of the most remarkable papers we have had before us. I am certainly sorry I limited Dr. Hart's time.

I believe this covers all the papers on nutritional diseases. If there is no discussion, I will call on Dr. A. F. Schalk to give the report of the Committee on Nutritional Diseases.

. . . Dr. Schalk read the report by title. . . .

REPORT OF COMMITTEE ON NUTRITIONAL DISEASES

Dr. A. F. Schalk, *Chairman*, Fargo, N. D.

Dr. B. A. Beach, Madison, Wis.
Dr. H. Schmidt, College Station, Tex.
Dr. C. H. Stange, Ames, Iowa.
Dr. Edward Records, Reno, Nevada.

About sixteen years ago (1912), Cassimer Funk gave to the world the first principles of the so-called "newer nutrition." This is, comparatively speaking, a relatively short period of time in the development of anything new, and is particularly true in the field of science where methods and technic must be devised, experiments repeated and results carefully checked and rechecked.

During this brief interval of time, hundreds of studies have been initiated and pursued in this new field of work, with the result that a large amount of basic knowledge of a fundamental nature has been obtained and recorded.

However enlightening and important this progress has proven to be, there remains a tremendous amount of research to be done along nutritional lines in an endeavor to establish more definitely what significance is attached to and what relationship exists between nutritional deficiencies and irregularities and health equilibrium in our domestic live stock.

In the absence of any specific instructions from the Association, since the inception of this Committee, the members in 1926 set about to formulate a rather definite plan of procedure which has been quite strictly adhered to since that time.

In accordance with this policy, the Committee endeavors to obtain, when available, nutritional specialists of authority to discuss before the Association the nutritional studies they are pursuing. This is supplemented with a committee report which consists of abstracts and brief reviews with references to the nutritional work that has been carried out during the previous year.

Nutritional Diseases of Swine

Nutritional diseases are perhaps more widespread among swine than any other species of our domesticated animals. Mineral constituents and vitamins have received most of the research man's attention during recent years. Unfortunately, a large majority of those working on nutritional diseases have selected laboratory animals, chiefly rats, for their work. One experiment station[1] very properly has stated: "The only experiments of value to agriculture are those done under practical conditions on farm animals, as the experimental results obtained in one species of animal are not directly applicable to another."

The work on iodin during the past year seems to have been limited, as not many publications have been issued. Some study[2] has been made of the iodin content of the drinking water. It was concluded from a study of the relation between the iodin content of drinking waters in various localities in England and Scotland, that no correlation can be established between a low iodin content in the drinking water and the endemicity of goiter. While goiter, as it is usually recognized in the human, is not met with in swine, beneficial results have been reported, both in the United States and in Europe, by adding small quantities of potassium iodid to the feed. From four European experiments[3] the following conclusions could be drawn:

1. That potassium iodid exerted a favorable influence on the birth weight and further development of pigs only when the feeding of potassium iodid is begun 5-6 weeks before farrowing.
2. The amount of potassium iodid per day and per sow should be 100 mg. Larger amounts seem to do no harm.
3. The action of potassium iodid appears more favorable as the conditions for raising pigs become unfavorable. When potassium iodid was administered 5-6 weeks before farrowing, the birth weight was 18.8 per cent greater than in control animals. When potassium iodid was fed for only 2-3 weeks, before farrowing, the birth weight was no greater than in control animals.
4. If conditions under which pigs are raised are unfavorable, potassium iodid has increased opportunity for favorable action. In some Yorkshire sows the weaning weight of the pigs was 15, 20 and 40 per cent greater than in controls. This favorable action of iodin can very largely be replaced by providing favorable conditions for swine production.

   In practice potassium iodid should be regarded as an agent which increases birth weight, weaning weight and resistance, especially during the less favorable seasons of the year. The same beneficial results seem to follow the proper use of potassium iodid in the United States.[4]

Some study is being made of the significance of metals (iron and copper) in nutrition of swine, but it is impossible to draw definite conclusions at this time. One authority concludes that "there appears to be no grounds for believing that the addition of iron salts to a grain ration is either beneficial or necessary."

Calcium and phosphorus continue among the most important ingredients required in making up our mineral deficiencies.

Bone meal added to a standard ration did not increase gains sufficiently to justify its use in one experiment,[6] while the conclusions in another case[7] were that a grain ration for pigs in winter or for dry-lot feeding was unsatisfactory because it lacked in minerals, vitamins and proteins. Stiffness, posterior paralysis and death may result. No paralysis occurred on rations containing

proper minerals and vitamins in addition to grain. Cod-liver oil with ground limestone added to grain rations produced rapid and safe growth. Good pasture proved the one best practical corrective.

The calcium question may very well be summed up as follows[8]:

1. Most food materials are low in calcium and rich in phosphoric acid. Therefore, there is usually a calcium deficiency. This is especially true of swine.
2. Calcium deficiency can be supplied only in such a way as to avoid adding any new acids to the body. Calcium phosphate and chlorate should not be used for this reason. Carbonates are indicated; calcium phosphate is indicated only when both calcium and phosphoric acid deficiencies are present.
3. Calcium deficiency may be supplied by using finely ground limestone or chalk (Schlemmkreide). They should contain less than 97 per cent of $CaCO_3$.
4. In swine the amount of calcium should be 2 per cent of the concentrated feeds. In feeding many legumes, 2.5 per cent; in mature animals, 1-1.5 per cent is sufficient.

One station[1] reports cottonseed meal poisoning in hogs with the following conclusion: "Cottonseed meal when used as the only protein feed in balanced rations with yellow corn and good minerals will prove poisonous to hogs."

An explanation of the action of antirachitic vitamin may be contained in the following statement from one of the experiment station reports:[9]

"Diets deficient in antirachitic vitamin cause alkalinity in the intestinal tract followed by rickets and death (rats). The ultraviolet rays of sunlight lower the alkalinity of the intestinal tract, as do also cod-liver oil and cholesterol exposed to sunlight. The lowered alkalinity increases the utilization of the bone-forming materials in the ration."

Nutritional Diseases of Poultry

While this phase of the report is more largely concerned with the nutritional work that has been reported during the last year, a brief statement of the nutritional requirements of chickens at this time may not be out of place.

The two most common vitamin deficiencies in poultry, especially chickens, are *Vitamin D*, which has to do with the assimilation of calcium; and *Vitamin A*, the lack of which is associated with nutritional roup, kidney lesions, paralysis, etc.

Vitamin B deficiency produces nervous disorders but is not common in chickens, as the ordinary grains contain an abundance of this vitamin.

Vitamin C: Chickens do not need this vitamin, as it has been shown that they are capable of manufacturing their own.

Vitamin E or the vitamin of sterility: The more recent work indicates that this vitamin is not essential in the reproduction of chickens.

Of the minerals *calcium* consumption by laying hens is comparatively large. *Phosphorus* is essential, but the requirement is not nearly so large as is calcium. *Iron* is essential although the requirement is undoubtedly low.

Vitamin D and the Assimilation of Calcium

During the past year much experimental data bearing directly and indirectly on this subject have been brought to light. The so-called glass substitutes so widely advertised and sold have come in for their share of investigation. Russell and Massengale[10] found that cell-o-glas was effective in admitting the ultraviolet rays.

The investigations of Steenbock, Kletzien, Halpin and Johnson[6] were carried on with baby chicks using ultraviolet ray from a quartz-mercury lamp, during the winter of 1926-27. All of these glass substitutes were found to transmit the ultraviolet ray, but the biological efficiency depends upon the time of exposure. Where the exposure has been ten minutes a day, all of these glass substitutes have been equally effective and practically as good as direct irradiation. Where the time of exposure has been reduced to three minutes per day, the cell-o-glas has not been so effective as the other three, although considerably better than ordinary window glass. Where the exposure has been as low as three minutes per week, about the same order of improvement has resulted, i. e., the Corning, vitaglass and flex-o-glas transmitted sufficient light

to bring about an improved calcium assimilation over that secured with cell-o-glas or ordinary window glass, but in no case was the effect as good as with direct irradiation. This work needs repetition, especially with summer and winter sunlight, before final conclusions can be drawn.

Studies with laying pullets: Eight pens of White Leghorn pullets were carried through the winter on the same ration and in the same poultry-house, except that the type of glass in the windows was varied. Two pens were given thirty minutes daily treatment with the quartz-mercury lamp, and one pen has 5 per cent of cod-liver oil added to the mash ration.

The pen subjected to sunlight passing through ordinary glass windows gave a 40 per cent hatch in February, 13 per cent hatch in March and zero in April; while the pen treated daily for thirty minutes with the quartz-mercury lamp hatched 78 per cent in February, 63 in March, and 78 per cent in April.

When ordinary glass windows were used (the windows were opened on sunny days), the hatch was 58 per cent in February, 39 per cent in March, and 72 per cent in April. The corresponding percentages for eggs from birds subjected to cell-o-glas were 58, 39, and 72 per cent; while for the vitaglass the figures were 57, 47, and 80 per cent.

Where common white cloth was used in place of glass, the eggs hatched 44 per cent in February, 28 per cent in March, and 33 per cent in April. In the lot receiving 5 per cent of cod-liver oil, but kept in a pen with windows made of ordinary glass, and these windows kept closed, there was a 63 per cent hatch in February, 30 per cent in March, and 55 per cent in April. It should be noted that there was an unusually large number of clear days, with bright sunshine, during February and March of 1927. It is planned to repeat this experiment for several years so as to check these initial results.

After May first, all hens were given access to direct sunlight. Pullets receiving cod-liver oil gave better summer egg-production than any of the other groups. Apparently, the pullets in the pens where the type of glass shut out a part of the ultraviolet light developed a condition comparable to rickets, and it required a considerable period of summer sunshine for them to recover sufficiently to permit high egg-production. The addition of 5 per cent of cod-liver oil to the mash was helpful in preventing the development of these symptoms of rickets.

Investigators at the Iowa Station[9] conclude that most of the glass substitutes will admit enough ultraviolet light up to ten weeks of age. Cell-o-glas, flex-o-glas and glass fabric were satisfactory while glass cloth was not. They furthermore conclude that the efficiency of these glass substitutes depends on their ability to admit 12 per cent of the beneficial rays of the sun as measured by the lithophone.

As to the effect of irradiation and direct exposure to the sun's rays, Mercer and Tozer[11] conclude that hens kept in the open sunlight and fed greens will not have egg-production increased by either cod-liver oil or irradiation.

Kempster[12] has shown that the hatchability of the eggs from hens subjected to irradiation or fed cod-liver oil or both was satisfactory, and also that the feeding of yellow-yolked eggs to chicks prevented leg weakness while the feeding of pale-yolked eggs did not.

The Crookston (Minn.) Sub-station[13] reports that cod-liver oil is very beneficial in egg-production and the hatchability of the eggs. Beach and Davis[14] conclude that salmon oil extracted from cannery refuse which contains the fish viscera was satisfactory in preventing rickets.

WHAT PART OF THE CHICKEN'S BODY IS ACTIVATED BY LIGHT?

The question is sometimes asked, "Can a hen receive benefit from ultraviolet rays striking any part of the body?" During the past year Halpin and Johnson, of the Poultry Department, working in conjunction with Hart and Steenbock (Agricultural Chemistry),[6] made a study with six groups of hens kept in quarters where no direct sunlight was available. The first group was placed under the quartz-mercury lamp daily for ten minutes. The second group was teated in the same way with all of the body of each hen covered except the

head. In the third group the feet and legs only were exposed. In the fourth group, bodies and feet were exposed, while in the fifth group, bodies were exposed, the feet, legs and head being covered, and the sixth group as a control was not given any irradiation.

The group where all parts of the birds were irradiated continued to lay well and give normal hatchability. The same was true where the heads only were treated (group 2), feet and legs (group 3), and the bodies and feet (group 4). Group 5, where only the body was irradiated, did not lay so well nor give as good hatchability as the first four groups. The sixth group, getting no ultraviolet light, went down in egg-production, averaging only 21.5 eggs per hen in seven months after being out of the direct sunlight and gave zero hatchability after the third month. The striking effect of irradiation, whether partial or complete, is most noteworthy when compared with the absence of ultraviolet light.

Cod-Liver Meal as a Source of Vitamin A and Vitamin D

During the past year this product has come upon the market especially for poultry feeding. It contains 45 per cent of oil and it would be presumed that it would contain liberally vitamins A and D. Experiments with chicks were undertaken by the departments of Agricultural Chemistry and Poultry Husbandry[6] to determine its potency in these respects, and it has been demonstrated that the preparations that this station has received have been effective sources for vitamin D, but have not contained vitamin A. As low as 1 per cent of this material in a baby chick ration prevented leg weakness and causes a normal calcification of bone.

The pathological condition brought about by the absence of vitamin A in the ration of the chick has been further studied and while it is rare that up to 6 or 7 weeks of age this species suffers from eye trouble (ophthalmia), a common symptom of vitamin-A deficiency, they, however, suffer very materially from the accumulation of urates in the ureters, with lesions in the liver and kidney. It may be that this pathological condition will be of value in the diagnosis of vitamin deficiency in poultry feeds and will have practical significance to the poultry industry because of the preparation of commercial poultry mashes low in vitamin A.

Ohio Station Bulletin 9 found that ultraviolet light was of more benefit than cod-liver oil in hatching eggs.

The Calcium-Phosphorus Ratio in Poultry Nutrition

There is a prevailing opinion that the relation of calcium to phosphorus in a ration must be very definite, the generally approved ratio being equal parts of calcium and phosphorus. The best development of the bones of the skeleton has been considered to take place only when these two elements were in this definite ratio.

Most of the experiments on which this belief is based have been conducted indoors with rats, and out of contact with unlimited amounts of the antirachitic factor. Chickens have large lime requirements, and it seemed desirable to determine whether these conclusions, which may apply to the winter feeding of poultry, might hold true also in summer, when the chickens were exposed to unlimited sunlight.

Hart, Steenbock and Kletzien (Agricultural Chemistry) and Halpin and Johnson (Poultry Husbandry)[6] made an investigation in which ten groups of chicks were given a basal ration of yellow corn, skimmed milk and common salt. In addition the various groups were fed different quantities of calcium carbonate and bone meal. The calcium-phosphorus ratios varied from one extreme of 1.2 to 1 to a ratio of 12 to 1, where 8 per cent of calcium carbonate was fed, and no bone meal. The birds were in outdoor pens with unlimited sunlight but the pens were so constructed that no additional feed was available.

At sixteen weeks of age, growth was quite alike in all groups excepting two. The group fed 8 per cent of lime and no bone meal, and those fed 8 per cent of bone meal and no lime evidenced depressed growth, and an analysis of their bones showed a lower ash content. From this it was apparent that the calcium-phosphorus ration can be varied within certain wide limits, at least to a basis of 7 to 1, without affecting growth or the development of the skeleton, provided

there is a generous amount of the antirachitic factor in the diet. However, it is still probable that in the winter, with a limited amount of sunlight, or its substitutes, the calcium-phosphorus ratio is of very great importance. But in the summer time the mineral ration may be greatly increased in its lime content, as compared to the phosphorus, or vice versa, with no ill effects.

The Kentucky Experiment Station[15] reports a comparison of calcium carbonate, calcium sulphate, calcium lactate, calcium chlorid and tri-calcium phosphate as sources of calcium for laying hens. All pens got the same basal ration of wheat, corn and skimmilk. These trials showed calcium carbonate superior. On the other hand the Ohio Experiment Station[16] found that when calcium sulphate, calcium lactate, tri-calcium phosphate, di-calcium phosphate, oyster shell, high-calcium limestone, dolomitic limestone, bone meal and certain rock phosphates were fed so that each contained the calcium found in 2 per cent calcium carbonate, the results were just as good.

Buckner, Martin and Peter[20] found that calcium carbonate was more effective than calcium sulphate, calcium lactate, calcium chlorid and precipitated tri-calcium phosphate.

Hughes, Titus and Smits[18] found that the calcium content of hens' blood varied between 13 mgs. per 100 cc up to 320 mgs. per 100 cc. From birth up to the laying period, the calcium content of the blood is 12-14 mgs. for 100 cc of blood.

According to the Iowa Station,[17] hens fed oyster shell or limestone laid 104 eggs per hen from April 6 to September 15. The hens fed clam shells laid 83 eggs each in the same time.

The Ohio Experiment Station[16] concludes that the minimum in calcium carbonate, fed with cod-liver oil in order to get normal bones, is 2 per cent.

The Wyoming Station[19] found that alfalfa leaves, added to a turkey ration, kept them from having crooked breast bones. When the basal ration was fed, the breast bones were crooked although this basal ration contained greens.

Vitamin A: There are several sources of vitamin A. In spite of this fact, however, the losses due to a lack of this vitamin are considerable, more in some sections of the country than in others. Yellow corn carries an abundance of this vitamin as does cod-liver oil and green leaves. Plummer, Rosendale and Raymond[18] recommend 1 per cent cod-liver oil to a ration not otherwise carrying it. Hart, Steenbock, Kletzien, Halpin and Johnson[6] found that cod-liver meal was an effective source of vitamin D but not of vitamin A.

Vitamin B: Does a mixed grain ration meet the vitamin-B requirements of chicks brooded on wire? Bethke and Kennare [21] found that a ration containing 63 per cent or more of ground whole grains (corn or wheat) and 10 per cent of other seed products such as soybean meal or bran and 20 per cent of either meat scrap or dried buttermilk, with adequate mineral and fat-soluble supplements, was found to meet the antineuritic requirements of chicks kept ten weeks on wire floors.

It has been shown that there are two factors associated with vitamin B: one, the antineuritic element, and another that has to do with growth. Williams[22] found that pigeons fed a mixture of rice, bran meal, and polish remained in good health. Where rice bran alone was fed, 25 per cent of the birds died in 32 days. The sciatic nerves showed fatty degeneration. The birds fed rice meal were normal for 120 days. Those fed rice polish suffered a small loss the second and third weeks. The sciatic nerves were slightly degenerated.

Vitamin C: (The vitamin of scurvy.) Chickens do not require foods containing this vitamin. An interesting observation is the fact that chickens can manufacture their own vitamin C. This vitamin has been found in the liver of chickens that had been kept on feeds that contained none of this vitamin.

Vitamin E: (The anti-sterility vitamin.) Evans and Burr[23] found that milk, fat and cod-liver oil are very low in this vitamin. Oats, corn, and wheat, especially the wheat germ, contain an abundance of vitamin E. It is found also in lettuce, dried alfalfa, rice, yellow corn, egg-yolk, and cooked meat. Rats fed milk casein, corn starch, lard, mineral, salts, butter, yeast and orange-juice grew normally but did not reproduce. The addition of lettuce, however, allowed them to reproduce. Both male and female are affected by this vita-

min. More recent work at the Idaho Experiment Station[24] indicates that the reproductive disorders of chickens cannot be remedied by the addition of vitamin E.

The importance of good proteins, carbohydrates and fats must not be overlooked. R. T. Parkhurst[24] concludes, as a result of some feeding trials, that pens in which animal protein ran low, the hatchability of the eggs was poor in spite of an abundance of all vitamins. From a nutritional viewpoint a combination of factors is necessary to get maximum hatching ability.

Prang and Carrick[26] found that the optimum growth was obtained in rations containing 10 to 12 per cent of meat and bone scrap. These investigators found that different brands of bone and meat scrap varied. A report from the Kentucky Station[15] indicates that 2.5 per cent meat scrap is sufficient for high egg-production where a milk supplement is fed.

Work conducted at the Mississippi Station[27] indicates that a ration containing 12.5 per cent cottonseed meal and 12.5 per cent meat scrap was better than any other protein combination, or combination with lime added. Arkansas Station Bulletin 21 reports a trial conducted to determine the effect of feeds on fertility and hatchability. They conclude that a basal ration of ecual parts wheat bran, grey shorts, yellow corn meal, and oat flour with 5 per cent meat scrap, with a scratch feed of 2 parts yellow corn and 1 part oats, is as good as any other combination.

Experiments conducted at West Virginia[29] failed to show that heavy egg-production just before the hatching season had any detrimental effect on fertility or hatchability.

Halpin, Johnson and Hart[6] obtained a 30 per cent chick mortality where meat scrap alone was used to supplement at basal ration. Where skimmilk was used there was no mortality.

Iron Requirements of Chickens

Some unpublished work at the Wisconsin Experiment Station indicates that while the iron requirement of chickens is low, yet anemia can be produced on iron-free diets. Iron is found is meat scrap, alfalfa, cabbage, etc.

Cole and Hutt[25] found in feeding thryoid glands to hens that there was no effect on body weight or egg-production or no lack of pigmentation, but that hen-feathering could be induced in the male.

Acherson, Blish and Mussehl[30] found that the addition of cystine, above the minimal requirements to the ration of hens, did not hasten the molt. Morgan and Woodruff[31] found that the addition of waste pimento peppers, ground and fed to hens at the rate of one-half gram per day, would color the egg-yolks and that the color first appeared after feeding for five days.

Chickens do not require the addition of iodin to the ordinary ration.

From the literature surveyed it does not appear as though nutritional diseases of cattle, horses and other domestic live stock were subjected to much investigation during the last year.

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DR. W. G. HOLLINGWORTH: I move that we accept the report without reading, but for publication in the proceedings.

. . . The motion was duly seconded, put to a vote and carried. . . .

PRESIDENT CARY: The next is the report of the Committee on Terminology of Diseases of Poultry. This report was to have been made by Dr. R. A. Craig, but Dr. F. H. Brown will present it. Owing to the technicalities of the report, we will ask him not to read it but just present it.

. . . Dr. Brown presented the report. . . .

(Dr. Craig was the official representative of the U. S. Live Stock Sanitary Association on the Terminology Committee of the National Poultry Council, and chairman of the Subcommittee on Disease Terminology. His report included the minutes of a meeting of the Terminology Committee, held October 24, 1928. The minutes are not reproduced here, but only that portion of the report covering disease terminology.—EDITOR.)

REPORT OF COMMITTEE ON TERMINOLOGY OF POULTRY DISEASES

DR. R. A. CRAIG, *Chairman*, Lafayette, Ind.
DR. F. H. BROWN, INDIANAPOLIS, IND. DR. J. E. GIBSON, INDIANAPOLIS, IND.

The following terms that relate to the control of poultry diseases, have been selected and defined by the Committee:

Agglutination test: A blood test for the diagnosis of bacillary white diarrhea and fowl typhoid. The test fluid or antigen is made from cultures of *Salmonella pullorum* or *Bacterium sanguinarium*.

Blood-tested flock: A breeding flock in which there are no individual birds that have bacillary white diarrhea or fowl typhoid, as shown by the agglutination test, applied just prior to the hatching season.

Disease-free flock: A flock in which there are no birds that manifest symptoms and lesions of disease, or that have been exposed to an infection at any time during a period of six months, preceding the examination for disease. Such a flock must have passed two annual negative tests, or three semi-annual negative tests for tuberculosis, bacillary white diarrhea, and fowl typhoid.

Disinfection: The act or process of destroying germs or microorganisms that cause disease. The disinfection of poultry-houses, brooders, incubators, drinking-fountains, etc., consists in the removal and proper disposal of the manure or droppings, a thorough cleaning of the walls and floors of the houses, surfaces of the drinking-fountains, etc., and applying to the clean surface any one of the following disinfecting agents: a three per cent water solution of liquor cresolis compositus, or any other chemical disinfectant of equal value; live steam; and placing in boiling water for a short time.

Pullorin test: An intradermal test for bacillary white diarrhea. Pullorin (prepared from *Salmonella pullorum*) is injected into the skin of the wattle. The positive reaction consists of a swelling of the part injected. This test is not considered as accurate a diagnostic test as the agglutination test.

Quarantine: To segregate or isolate on account of being affected with, having been exposed to, or suspected of having any infectious or communicable disease.

Quarantine period: The period of time that must elapse before an individual bird or flock, exposed to an infection or attacked by it, is incapable of transmitting the infection or developing the disease. The examination of the flock for the presence of disease must include laboratory or diagnostic tests.

Tuberculin test: The injection of tuberculin (prepared from the avian tuberculosis bacillus) into the skin of the wattle. The reaction in the tuberculous bird consists of a swelling of the part injected.

PRESIDENT CARY: Gentlemen, you have heard the report. This is not final and of course a committee of this kind will naturally have to take on growth for another year or more, before any great work can be done. This report is before you for adoption.

DR. HOLLINGWORTH: I move that we adopt the report.

. . . The motion was duly seconded, put to a vote and carried. . . .

PRESIDENT CARY: The next committee to report will be the Tuberculosis Committee.

DR. C. E. COTTON: Mr. Chairman, you understand that one of the main duties of this committee is to prepare the program on tuberculosis. We have no apologies to make for the program at this session and we want to thank the men who presented papers. However, as you all know, in the past few years we have had a great many papers and it has been the custom to wait until all the papers have been presented and then ask for a general discussion. As a result there has been no discussion. This year we undertook to ask the men who were to present papers to name the men whom they wished to discuss their individual papers in the hope that we could get a free discussion. I am frank to say that only one of the men on the program expressed himself, designating an individual to open the discussion and that was Dr. Wight, who suggested that Dr. Killham discuss his paper and we will blame the presiding officer for not seeing Dr. Killham. Dr. Van Es responded but did not want to designate any individual to open the discussion, stating that he would depend on the members present to await the spirit as it moved them. The fact remains that we had some wonderful papers but the lack of discussion, at least in my opinion, was regrettable.

We think in the future, in fact the Executive Committee last night decided, that it will be mandatory for each man who prepares a paper to designate somebody to open the discussion and that the authors present their papers to those selected to discuss them prior to the meeting, in order that these men will be prepared to discuss the papers. Even if it is necessary to have fewer papers, we feel that this is very desirable. We can read these papers later. We have men engaged in the same line of work as the men who present the papers and the discussions, as has been proven since yesterday at the noon hour, are very valuable.

Your committee report is very short and is signed by all members of the Committee.

. . . Dr. Cotton read the report. . . .

REPORT OF COMMITTEE ON TUBERCULOSIS

DR. C. E. COTTON, *Chairman*, St. Paul, Minn.

Dr. A. E. Wight, Washington, D. C.
Mr. A. J. Glover, Fort Atkinson, Wis.
Dr. M. Jacob, Knoxville, Tenn.
Dr. V. A. Moore, Ithaca, N. Y.
Dr. L. Van Es, Lincoln, Nebr.
Dr. E. A. Watson, Ottawa, Ont.

Your committee believes that the solution of the problem of tuberculosis lies in preventing exposure to infection.

RECOMMENDATIONS

I. In the work of tuberculosis eradication, when dealing with infected premises, it is urged, before officially recognizing such premises as being free of tuberculosis, that the possibility of the swine being infected be given serious consideration.

II. The possibility of re-infection from feeder cattle can not longer be ignored and it is, therefore, recommended that on or before July 31, 1931, the Rules and Regulations of the Uniform Accredited Tuberculosis Free Area Plan be amended, requiring that all feeder cattle, including steers, bulls and females, moving into Modified Accredited Free Area, be permitted only under the same provisions as are now required for dairy and breeding cattle.

DR. HOLLINGWORTH: I move the adoption of the report.

. . . The motion was duly seconded, put to a vote and carried. . . .

PRESIDENT CARY: The next report is from the Committee on Miscellaneous Transmissible Diseases, by Dr. A. W. Miller, Assistant Chief, Bureau of Animal Industry, Washington, D. C. Dr. Miller!

DR. MILLER: Mr. Chairman, the reports of the Committee on Miscellaneous Transmissible Diseases for the past three years have dealt in considerable detail with foot-and-mouth disease, anthrax, hemorrhagic septicemia, rabies and glanders. The Committee has presented to the Association information concerning research discoveries by workers in various parts of the world and has made recommendations that they thought, if put into effect, would lead to better control and eradication measures. The United States has been free from foot-and-mouth disease for more than three years. The disease still exists in practically all the countries which were infected a year ago and those countries then free are still free.

The British Research Commission on foot-and-mouth disease has continued its work. There is only one feature of the foot-and-mouth disease research work that we desire to call to your attention this year. We covered that quite thoroughly last year and that is the determination that bichlorid of mercury apparently is not an effective agent against foot-and-mouth disease.

The situation with respect to glanders is excellent. Very few cases of the disease have occurred in the United States this year.

Hemorrhagic septicemia continues to cause considerable loss.

Rabies has been unusually prevalent in a number of sections of the United States. The Committee was hopeful that it might at this meeting submit more definite information concerning the value of preventive treatment against rabies and hemorrhagic septicemia, but the available data were not considered sufficient to warrant us in making more definite recommendations than heretofore. Therefore, this year we are submitting only this brief statement as our report. (Applause)

PRESIDENT CARY: Gentlemen, a motion to adopt this report is in order.

. . . It was moved, seconded and carried to adopt the report. . . .

PRESIDENT CARY: The next committee to report is the Committee on Unification of Laws and Regulations, Dr. W. J. Butler, State Veterinarian, Helena, Montana.

. . . Dr. Butler read the report. . . .

REPORT OF THE COMMITTEE ON UNIFICATION OF LAWS AND REGULATIONS

DR. W. J. BUTLER, *Chairman*, Helena, Mont.

Dr. U. G. Houck, Washington, D. C.	Dr. H. C. Givens, Richmond, Va.
Dr. W. J. Fretz, St. Paul, Minn.	Mr. J. H. Mercer, Topeka, Kans.
Dr. R. W. Smith, Concord, N. H.	Dr. C. J. Marshall, Philadelphia, Pa.

The basic outline for uniform regulations was so ably presented by the Committee on Uniform Regulations at the twenty-ninth annual meeting of this association that it would be confusing for your present committee to enter into a lengthy summary or discourse on uniform regulations.

We will therefore limit our report to concise recommendations:

1. We recommend that all states adopt and follow as closely as possible the basic outline for uniform regulations as presented at the twenty-ninth

annual meeting of the United States Live Stock Sanitary Association (see pages 178 to 188, 29th Annual Report of the U. S. L. S. S.A., year 1925).

2. Your committee again calls your attention to the decision of the Supreme Court of the United States, No. 187, October term, 1925. This decision in effect declared that state quarantines were not operative on interstate shipments when specific authority to govern the spread of disease has been delegated to the federal government.

We recommend that this association authorizes its legislative committee to have drafted and presented to congress an amendment to the existing federal laws which will give states the right to establish and enforce quarantines for animal and poultry diseases, on shipments of live stock or poultry consigned to or passing through the respective states.

3. We repeat the recommendation previously submitted to you with reference to the word "accredited" in the accreditation of poultry.

(a) The word "accredited" shall be used only to indicate freedom from disease.

(b) That when the word "accredited" is so used, the name of the disease to which reference is made, be attached as in the following sentence:

Accredited Bacillary White Diarrhea Free
Accredited Tuberculosis Free

We recommend that in the interest of uniformity, bearing in mind the above recommendations, that the various states adopt such regulations on this subject as may be adopted by the United States Bureau of Animal Industry.

4. We recommend the establishing of accredited abortion-disease-free herds.

Dr. Butler: I move that we adopt the report.

. . . The motion was duly seconded, put to a vote and carried. . . .

President Cary: There are some recommendations there that should be taken care of a little later by committee appointments, especially with regard to the recommendation that Congress adopt something that will enable states to quarantine.

I dislike to talk on this subject from the chair, but I handle those questions in just this way: When they get into the state of Alabama, *I* take care of them. (Laughter)

The next is the report of the Committee on Legislation, Professor H. R. Smith, of Chicago.

Mr. J. M. Whittlesey: Professor Smith told me last night that he would be unable to be here today and asked me to express his regrets and say that he had had no calls for the services of the Committee on Legislation. Therefore, there was no report to be made. He reviewed the action of the Committee two years ago in backing up the Bureau of Animal Industry regarding the federal appropriation which he judged was fairly satisfactory. There has been no necessity for further services along those lines since that time.

President Cary: There is only one other committee. Is the Committee on Resolutions ready to report? Dr. T. E. Munce is chairman.

. . . Dr. Munce read the report. . . .

REPORT OF COMMITTEE ON RESOLUTIONS

Dr. T. E. Munce, *Chairman*, Harrisburg, Pa.

Dr. R. A. Craig, Lafayette, Ind.
Dr. B. J. Killham, Lansing, Mich.
Dr. J. H. McNeil, Trenton, N. J.
Dr. J. H. Barger, Des Moines, Iowa.

Resolution

Whereas, There is great confusion and misunderstanding regarding the correct meaning and use of the word "accredited" when applied to poultry, and

Whereas, The United States Live Stock Sanitary Association was responsible for inaugurating and supporting legislation defining the use of the word "accredited" as applied to freedom from tuberculosis in cattle, and

WHEREAS, The responsibility for the efficient enforcement of state and national regulatory measures for poultry disease prevention and eradication requires clear, sound, consistent and authoritative terminology, and

WHEREAS, Members of the veterinary profession are called upon to assume important responsibilities in cooperation with other state, provincial, and national agencies in carrying out educational and regulatory programs for animal disease eradication and, therefore, should have the benefit of an authoritative statement from this association regarding correct terminology, and

WHEREAS, There is a commendable movement actively underway to establish an official national uniform plan for standardization of poultry breeding and disease eradication, therefore be it

Resolved, That this association go on record emphatically that the word "accredited" be used exclusively to mean the same with poultry as it does now officially with the case of cattle, namely, specific disease eradication by official testing and sanitation combined, and further, that in order to distinguish eradication of specific diseases, the abbreviation for the disease be prefixed to the word "accredited" as "T. B. Accredited" for poultry as now with cattle, and "B. W. D. Accredited" for bacillary white diarrhea and for other diseases as approved methods for official testing in the future may be perfected.

RESOLUTION

WHEREAS, There is an ever-present danger of foot-and-mouth disease and other dangerous and fatal contagious diseases being imported into the United States, through the importation of meat and animal products, from countries where such diseases exist, and

WHEREAS, The importation of such dangerous or fatal contagious diseases would be disastrous to the live stock and dairy interests of the United States, and

WHEREAS, It is a well-known economic fact that the prosperity of our country is dependent upon the prosperity of the live stock and agricultural interests in the United States, now, therefore, be it

Resolved, That we heartily approve and indorse the action of the Secretary of the United States Department of Agriculture in prohibiting the entry of meat and restricting the importation of animal products into the United States from countries where such dangerous live stock diseases exist and that we call the attention of the Secretary of Agriculture and the Congress of the United States to the necessity of maintaining such embargo until these dangerous and fatal live stock diseases have been eradicated by the countries affected by such embargo, and be it further

Resolved, That a copy of this resolution be forwarded to the President and President-Elect of the United States, the Secretary of Agriculture, the Chief of the United States Bureau of Animal Industry and the members of Congress.

. . . Motion was duly made, seconded and carried to adopt the report. . . .

PRESIDENT CARY: We have had the reports of all the committees with the exception of the Committee on Policy. Is Dr. Mohler present or is any member of the Committee ready to report?

DR. CONNAWAY: I had intended seeing the Committee which has just finished reporting, to get in a little special thing that I think we ought to include. I believe this association ought to send greetings to one of the few older men who is still living and who helped to organize this body and that is Robert J. Kleberg, of Kingsville. I think it would be a nice thing for our Secretary to be instructed to send him the greetings of this association. I make that as a motion.

. . . The motion was duly seconded, put to a vote and carried. . . .

PRESIDENT CARY: Is there any other business to come before this organization?

Dr. Gibson: I am rising for information. If my memory serves me right, we have today voted in one instance to say, in regard to this terminology on poultry, "accredited bacillary white diarrhea," and the last action was to say "bacillary white diarrhea accredited." I wonder if the record shows that in one instance we have prefixed the word "accredited" and in another suffixed it.

President Cary: I think that is possibly true, but that can be remedied. I don't think there was any intention of a conflict. It was simply that there be a uniform use of the term "accredited" applied to the disease.

The next business in order is the election of officers and first will be the election of a president.

Dr. N. F. Williams: Mr. President and Members: This has been a most inspiring and instructive meeting. No organization has greater advantages than ours and I believe that it can be said truthfully that the members of no organization possess greater energy or ability. In the affairs of all organizations honest differences of opinion may arise in regard to minor policies, but surely there never have been any such differences as to the need of unflinching perseverance in handling the vital public health and economic problems with which we have been concerned. We have still further duties to perform; new problems have been added to the old to be solved; menaces of the human race to be overcome, the task of demonstrating that we have the skill and the will to control this machinery that this great system of modern civilization has created. We have the obligation to this organization of perpetuating this sound leadership. It is impossible to sum up genius in a single phrase. Outstanding men, regardless of field and not limited to narrow forms, recognizing the needs of each occasion, go out of themselves to become the men for the time and the opportunity. The sound leader has sympathies as well as judgments, emotions as well as intelligence. His messages are usually simple, direct and forceful, finding their way readily to the popular understanding.

The man I have in mind as fitting this mode is not here today. Unfortunately this is one of the few meetings that he has missed. After years and years of service he finds himself today confined to his bed, recovering from a serious major operation.

I shall place in nomination, for the office of president of this organization, Dr. Charles G. Lamb, of Colorado, and ask that you give to him this task that none could so ably handle as he. (Applause)

Dr. J. S. Healy: Anything said to this audience in regard to Dr. Lamb would be superfluous. You all know him and you have mingled with him and it is with a sense of pleasure that I arise to second the nomination of Dr. Lamb for the presidency.

President Cary: Are there any further nominations?

Dr. Hollingworth: I move that the nominations be closed.

. . . The motion was duly seconded, put to a vote and carried. . . .

President Cary: As we have only one candidate, a motion to elect by acclamation or have the Secretary cast the ballot for this man will be in order.

Dr. Gibson: I move that the rules be suspended and the Secretary instructed to cast the unanimous vote of the organization for Dr. Lamb as president.

. . . The motion was duly seconded, put to a vote and carried. . . .

Secretary Dyson: As per instructions, I cast the ballot for Dr. Lamb for president.

President Cary: Next there are three vice-presidents to be elected.

Dr. Butler: I should like the pleasure of placing in nomination the name of a man on whose shoulders rests a great work that is being carried on in the United States today, Dr. A. E. Wight, of Washington, D. C. (Applause) I place his name in nomination for first vice-president.

President Cary: Are there any further nominations for first vice-president?

Dr. Munce: I should like to place in nomination Mr. J. M. Whittlesey, of Connecticut, to represent the organization as second vice-president.

President Cary: Are there any other nominations?

Dr. Fitch: Last year I had the honor to place in nomination one of my old friends and co-workers in the state of New York, a man who has been associated with this body for many years. I should like to place his name in

nomination again at this time as third vice-president, Dr. W. G. Hollingworth, of Utica, a man prominent in the activities of better meat and better milk in the state of New York. (Applause)

Dr. Williams: I move that the rules be suspended, the nominations be closed, and the vote be by acclamation.

. . . The motion was duly seconded, put to a vote and carried. . . .

President Cary: The Secretary will cast the ballot for the three nominees.

Secretary Dyson: I cast a ballot for Dr. Wight as first vice-president; Mr. Whittlesey, as second vice-president, and Dr. Hollingworth, as third vice-president. (Applause)

President Cary: The President-elect is not here to be presented, so we shall call the First Vice-president forward and let him initiate the rest of them.

. . . First Vice-president-elect Wight took the chair. . . . (Applause)

Past-President Cary: I shall give to you the gavel and with it all the emoluments and everything else that goes with it. You may preside in the absence of the President-elect and may initiate or put into office the other members.

Vice-President Wight: Gentlemen, I shall try not to be any more severe than Dr. Cary was with this instrument which he handled so freely during this convention. I am very sorry that Dr. Lamb is not with us today and I certainly hope that he is feeling much better and will be here next year.

I haven't the slightest idea of the next item on the program but I shall be glad to have the vice-presidents who join with me in this great honor to step forward, Mr. Whittlesey and Dr. Hollingworth. (Applause) We would like to hear from both of you.

Mr. Whittlesey: Mr. President and Gentlemen of the Convention: I am in no sense a speech-maker. I have been deeply interested in the work of this association and in the convention for the last twelve years. I have missed only one meeting during that time and I have always been wonderfully repaid for my visit to Chicago, not only from listening to the program but from meeting the members and delegates from other states.

I appreciate the honor of being elected Vice-president of this Association and assure you that I shall try to carry on with proper humility under the President and the First Vice-president. (Applause)

Dr. Hollingworth: Mr. President and Gentlemen: I thoroughly appreciate this honor and I certainly shall do my duty. (Applause)

Dr. Butler: I want to pass a resolution and thank Dr. Cary for the exceptional and efficient way in which he has conducted this meeting. I want the Association to thank Dr. Cary and Dr. Dyson, and particularly the gentlemen who read such wonderful papers, and all who participated in providing us with this program, which I think we will all admit was an outstanding program. I know that some of us come a long distance and we have been amply repaid. We have been paid a thousand times over for coming here.

On behalf of the Association I thank all of them very sincerely and I would ask that the Association pass a resolution thanking all of them for their participation in this program. I make it a rising vote of thanks.

Vice-President Wight: You have all heard Dr. Butler's resolution. What is your pleasure?

. . . The audience arose and applauded. . . .

Dr. Cary: I want to thank you for the flowers and I want to say to you that last night after I went down to Sears, Roebuck's broadcasting station on the twenty-third floor of the Straus building, on the way back I felt a little tired and I stopped at the Grand Opera and heard the prettiest Spanish girl I ever saw sing. (Laughter)

Dr. Williams: I move that we adjourn.

. . . Upon motion duly made and seconded the meeting adjourned at 4:00 p. m. . . .

ADJOURNMENT.

REPORT OF THE COMMITTEE ON PARASITIC DISEASES

Dr. Maurice C. Hall, *Chairman*, Washington, D. C.

Dr. A. T. Kinsley, Kansas City, Mo.
Dr. A. L. Shealy, Gainesville, Fla.
Dr. R. P. Marsteller, College Station, Tex.
Dr. E. M. Nighbert, Moultrie, Ga.

Your Committee on Parasitic Diseases of Live Stock submits the following report:

Importance of parasites: Parasites of live stock are of great importance in the United States, and their importance is usually underestimated. Many veterinarians state that half of their practice deals with parasites. There is a growing appreciation of the importance of parasites, but there is also a growing importance of parasites. It is a matter of common report that areas in which parasitic diseases constituted a relatively unimportant condition up to a rather recent period are now beginning to report considerable trouble from parasites. This fact follows from the disappearance of the open range, the sure elimination of the clean areas formerly offered by a new country to the pioneer, the concentration of stock under more intensive methods of live stock production, and the spread of parasites in the rapid and extensive movements of stock under modern conditions.

To combat parasitic diseases, we have the following means: Sanitation, treatment, education, and regulatory measures.

Sanitation: Sanitation is one of the most effective and cheapest of control measures for some parasites. It has the advantage of being a preventive measure, and when it can be applied effectively it is the most desirable measure to use. It has given spectacular results in such cases as that of the swine sanitation system. The stockman should utilize what is known ot sanitary procedures, and the county agent and other educational agencies can be of great service in spreading information in regard to correct sanitary procedures.

Sanitation, however, has its limitations. In many cases we do not yet know enough to outline effective sanitary measures for parasites and can not prevent their occurrence and spread. In some cases it has been impossible to apply sanitary measures to an extent which would control parasites. Man, a thinking animal, can apply sanitation to a high degree which is impossible to his live stock. Our pasture animals in general must utilize feed which is certain to be contaminated with fecal material carrying the eggs, larvae and cysts of parasites. At the present moment we are compelled to fall back on treatment for the control of many parasites.

Treatment: In the case of such parasites as the common stomach worm of sheep, it rarely happens that the stockman has enough range or enough fields to enable his sheep to escape these prolific and persistent parasites by sanitation alone under the conditions existing over a large part of the United States. Under such conditions it is necessary to resort to treatment. These treatments are primarily the business of the veterinarian, and the competent veterinarian should be employed whenever available to combat these conditions. It will be many years before we shall be able to control certain parasites without recourse to treatment.

Education: One of the first duties of educational agencies is to carry out research, and in the field of parasitology much research is needed to ascertain the basic facts on which to develop control measures, and after these basic facts are ascertained to develop these control measures in the form of sanitation in its broad aspect as preventive medicine or in the form of treatments for use until better control measures are formulated. It is perhaps not too optimistic to say that sooner or later we must plan for the eradication, at least on restricted areas, of many of the parasites which are now complacently accepted as unavoidable accompaniments of the live stock industry.

As fast as basic facts and suitable measures are developed, it is the duty of the educational agencies to transmit them to those who can make use of them. Here the extension service, the press, the radio and other educational agencies may be utilized to great advantage, and here the United States Live Stock Sanitary Association has an important role.

It is self-evident that the quantity and quality of research and education in a restricted sense will be determined by the number and ability of the persons engaged in this work. In this connection we call attention to the fact that there are too few workers in this field who are engaged in work in parasitology. Probably every state in the Union that has a live stock or poultry industry of any importance should have at least one parasitologist investigating parasitic diseases of live stock, and in many states a staff of such workers is needed.

Regulatory measures: Some parasites lend themselves very readily to control in part by means of regulatory measures. The cattle fever tick and the various mange mites fall in this group. They are easily detected and can be destroyed with certainty by certain well-established means. However, most parasites, including almost all of the internal parasites, do not lend themselves to control by regulatory measures, owing to the difficulty in diagnosis, the uncertainties of treatment in many cases, and the fact that the parasites usually produce chronic conditions along the line of varying degrees of unthriftiness and hence do not seem important enough to warrant legal and regulatory measures. We are in accord with the idea that regulatory measures, as far as we can judge at present, should not be applied to any more parasitic diseases at this time, and that now and in the future educational measures are more important for the control of parasites.

Recommendations: In view of the fact that previous recommendations of your Committee on Parasitic Diseases have not been acted on by the Association or its Executive Committee, this Committee has no recommendations to make.

(The report of the Committee on Parasitic Diseases of Live Stock was called for by the Chair, but was not presented at the meeting. EDITOR.)

33rd

Annual Meeting

United States

Live Stock

Sanitary Association

Hotel La Salle, Chicago

December 4-5-6

1929

ARMY VETERINARY SERVICE

CHANGES RELATIVE TO VETERINARY OFFICERS

Regular Army

Captain Gerald W. FitzGerald, V. C., is relieved from duty at the Kansas State Agricultural College, Manhattan, Ks., on or about June 1, 1929, and directed to report to the commandant, Army Veterinary School, Army Medical Center, for duty. The name of Captain FitzGerald, is removed from the detached officers' list, effective upon relief from his present duty.

Captain Harry E. Van Tuyl, V. C., is relieved from duty at the Presidio of Monterey, Calif., to take effect on or about May 15, 1929, and is detailed to the Kansas State Agricultural College for duty, and on the same date transferred to the detached officers' list.

First Lieutenant Verne C. Hill, V. C., is relieved from duty at Camp Marfa, Texas, and directed to sail on transport leaving San Francisco on or about March 9, 1929, for duty in the Philippine Islands.

Major Clifford C. Whitney, V. C., is relieved from duty at Fort Robinson, Nebr., and directed to sail on transport leaving San Francisco on or about May 25, 1929, for duty in the Philippine Islands.

Each of the following-named officers is assigned to duty at the station indicated after his name, effective upon completion of his present tour of foreign service:

Major Harold E. Egan.........Fort Ethan Allen, Vt.
First Lieut. L. E. Schweizer.....Camp Marfa, Texas.

Colonel Robert Vans Agnew, V. C., Fort Oglethorpe, Ga., is directed to proceed to his home, February 5, 1929, and await retirement.

Each of the following-named officers of the Veterinary Corps is relieved from further assignment and duty at the Army Veterinary School, Army Medical Center, Washington, D. C., and from temporary duty at the Medical Field Service School, Carlisle Barracks, effective upon completion of present course of instruction, on or about May 31, 1929, and will proceed to the station specified and report in person to the commanding officer thereof for duty:

Captain George L. Caldwell.....Fort Oglethorpe, Ga.
Captain Edwin K. Rogers......Fort McIntosh, Texas.
2nd Lieut. John L. Owens......Fort Sam Houston, Tex.
2nd Lieut. Maurice W. Hale....Fort Sam Houston, Tex.
2nd Lieut. Charles S. Greer.....Fort Bliss, Texas.
Captain Philip H. Riedel........Army Veterinary School, Washington, D. C.
Captain Peter T. Carpenter.....Veterinary Dispensary, Washington, D. C.
Captain Fred C. Waters........Presidio of Monterey, Calif.

Reserve Corps

Promotions

Magens, Hans J....1st. Lieut...P. O. Box 700, Fredericksburg, Texas.
Steibing, C. C......1st. Lieut...421 Collins Ave., Baltimore, Md.

Hoskins Medal Awarded

At the graduation exercises held in the Red Cross House, the Army Medical Center, Washington, D. C., January 31, 1929, the Hoskins Medal was awarded to Captain George L. Caldwell, V. C., U. S. A.

MISCELLANEOUS

Foot-and-Mouth Disease in California Apparently Under Control Again

Thirteen days after the appearance of foot-and-mouth disease in a herd of hogs near Whittier, Calif., the disease reappeared among cattle about eight miles away, near Downey, in Los Angeles County. This was on January 31. By February 6, the infection had been detected in four herds of cattle. One of these was located near Whittier, where the disease first appeared among hogs. The others were in the vicinity of Downey and there is very good evidence to believe that the infection was spread by a calf-buyer, who visited some of the premises on which the disease appeared.

Up to February 15, ten days after the last appearance of the disease in southern California, there appeared to be no further spread of the infection. All live stock within a radius of about twenty miles of the four infected premises had been carefully examined by trained veterinarians and no evidence of the disease had been found on any of these farms, although practically a month had elapsed since the initial outbreak.

The infected territory is still under quarantine and even though all the infected premises have been thoroughly cleaned and disinfected, these must be tested for the presence of lurking infection by introducing susceptible animals and allowing these to remain on the premises for at least sixty days. Only in the event of these test animals remaining healthy for at least sixty days can the disease be considered completely eradicated.

As an additional precautionary measure, Director George H. Hecke, of the California Department of Agriculture, has appointed six veterinarians as special inspectors at the three ports of California. Two of these veterinary inspectors have been assigned to Los Angeles; two to San Francisco; and two to San Diego. It is expected that these veterinarians will be kept permanently at these ports, to keep strict watch on vessels from countries in which foot-and-mouth disease exists. All vessels coming from such countries will be inspected on arrival and, if any are carrying meat taken on while in infected countries, this meat will be placed in special compartments and sealed by the inspectors, the seals not to be broken until the vessels have left port. No garbage will be allowed to be taken ashore until after inspection and then only to be burned immediately.